Weston & Sampson

westonandsampson.com

1 Winners Circle, Suite 130
Albany, NY 12205
tel: 518.463.4400

CONTRACT DOCUMENTS

April 7, 2022

VILLAGE OF

***Ardsley***

NEW YORK

# *NEW PUBLIC WORKS FACILITY*

***220 Heatherdell Road***

***Village of Ardsley***

***New York 10502***

***VOA1811***

***ISSUED FOR: BIDDING***

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# SECTION 00 01 00
# PROJECT MANUAL PREFACE

| | |
|---|---|
| Owner: | Village of Ardsley<br>507 Ashford Avenue<br>Ardsley, NY 10502 |
| Project: | New DPW |
| Intent: | The project is subject to general Municipal Law 101 (Wicks Law) requiring a minimum four prime contracting areas and shall be bid in five contracts as follows:<br>Contract No. 1811-001 – General Construction (GCC)<br>Contract No. 1811-002 – Plumbing Construction (PC)<br>Contract No. 1811-003 – Fire Protection Construction (FSC)<br>Contract No. 1811-004 – Mechanical (HVAC) Construction (MC)<br>Contract No. 1811-005 – Electrical Construction (EC) |
| Architect: | Weston and Sampson<br>1 Winners Circle, Suite 130<br>Albany, NY 12205 |
| Construction Manager: | Calgi Construction Company, Inc.<br>56 Lafayette Avenue, Suite 350<br>White Plains, NY 10603 |

NOTES TO BIDDERS:

1. The Village is a tax-exempt entity.
2. **The Contractor will obtain all other State, County and other local permits and pay fees that are in force for this project.**
3. Bidders shall be required to use a surety authorized to do business in the State of New York. Said surety shall be used for all bonds required.
4. Any reference to "Contractor" shall mean any Prime Contractor.
5. **Contractor is responsible for all the requirements for Divisions *00 thru 34 and* Appendixes of these specifications and the entire set of contract documents.**
6. It is the responsibility of the Contractor to forward addenda and other pertinent information to subcontractors, suppliers and vendors.
7. Scope of work is defined in Section 01 10 00-Summary thru Section 01 90 00, as well as within other technical sections within the specifications and shown on the drawings.
8. **It is the responsibility of the Contractor to familiarize himself with the entire Drawing Set and Specifications in order to coordinate his work.**
9. Every request for information or interpretation of Specifications, Addenda, or Contract Drawings must be addressed in writing using the enclosed form in the specifications (Section 000215) and either faxed, or scanned and emailed to the Construction Manager, Calgi Construction Company, Inc. T. 914-682-9423, F. 914-682-9420 Email: dchen@calgiconstruction.com, Attention Mr. David Chen with required copy to the Architect as noted in Section 00 02 12 Instructions to Bidders.
10. The words "Specification" and "Project Manual" are interchangeable, both referring to this document.
11. Contractor shall warrant its work and materials for one (1) year or more, starting at the date of substantial completion of the project.
    a. Warranties will only begin if the item, system, equipment etc. is in Good Working Order and has been accepted by the Village.

b. Specific sections in the specifications and certain systems and materials may define a longer warranty period.

END OF SECTION 00 01 00

# NOTICE TO BIDDERS

PUBLIC NOTICE is hereby given that sealed bids will be received by the Village of Ardsley at the office of the Village Clerk, 507 Ashford Ave, Ardsley, NY 10502 for the New DPW Project of 220 Heatherdell Road, Ardsley, New York 10502.

Contract No. 1811-001 – General Construction (GCC)
Contract No. 1811-002 – Plumbing Construction (PC)
Contract No. 1811-003 – Fire Protection Construction (FSC)
Contract No. 1811-004 – Mechanical (HVAC) Construction (MC)
Contract No. 1811-005 – Electrical Construction (EC)

The bids shall be in accordance with the Specifications, Drawings and Terms of the proposed Contract. All Proposals shall be enclosed in a sealed envelope bearing the name and address of the Bidder, addressed to Ms. Ann Marie Rocco, Village Clerk, Village of Ardsley, 507 Ashford Avenue, Ardsley, NY 10502 and endorsed **"New DPW"** until **11:00 a.m**. prevailing time on **Thursday, May 5, 2022** and immediately thereafter the bids will be publicly opened and read aloud in the said office. No proposals will be accepted after said time and date.

## OBTAINING DOCUMENTS

The Contract Documents, including Drawings and Specifications, may be viewed after **11:00 AM**, **April 7, 2022** A link to the FTP site for free downloading PDF files of the contract documents will be available to bidders upon email request to the Construction Manager, Calgi Construction Company, Inc. Attention: Mr. David Chen Email: dchen@calgiconstruction.com. If you would like to purchase hard copy sets of the plans and/or specifications please contact the printer for this project. Plans4Less.com Email: plans@plans4less.com Phone: 855-752-6745 Attn. Brian Burke**.**

## BID SUBMISSIONS

Bids shall be made on the Proposal forms furnished with the Specifications, and must be accompanied by a Bid Bond acceptable by the Village, in the amount of not less than 5% of the total amount of the Bid. Bidders who submit certified checks must accompany them with a Consent of Surety from a recognized Bonding Company. Checks shall be made payable to the Village of Ardsley, NY and are to be held by the Village as a guarantee for the proper execution and delivery of the Contract and bonds to secure the faithful performance thereof. In default of such execution and delivery of Contract and Bonds, the amount of the deposit represented by the check shall be forfeited and retained by the Village as liquidated damages. No Bidder shall withdraw his bid within **sixty days (60)** after the formal opening thereof.

The Owner reserves the right to waive any informality in any proposals, or to reject any or all proposals and to advertise for new proposals. The accepted low bidder(s) will be required to furnish a 100% Performance Bond and a 100% Labor and Material Payment Bond.

## Pre-Bid Meeting

A Pre-bid meeting is scheduled for **Tuesday, April 19, 2022** at the site, 220 Heatherdell Road, Ardsley, New York 10502 at **11:00 a.m. Attendance for this meeting is highly recommended for all bidders**.

**Dated:** April 7, 2022

**By: Ann Marie Rocco**
**Village Clerk**

END OF SECTION 00 01 13

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# INSTRUCTIONS TO BIDDERS

1. DOCUMENTS: Complete sets of Bidding Documents will be issued for bidding purposes as stated in the "Notice to Bidders". A complete set of Bidding Documents consists of the following:

   a. Project Manual/Specifications.

   b. Addenda (if any).

   c. Contract Drawings.

2. BID PROPOSALS: To be considered, bids must be in accordance with these Instructions to Bidders. All bids must be submitted on the prescribed forms as included herein and as bound in the Specifications titled as: Bid Proposal. All blank spaces for bid prices must be filled in, in both words and figures, either typed or in ink. Bids Proposals that contain any omissions, erasures, alterations, additions, or items not called for in the itemized Bid Proposal, or that contains irregularities of any kind, may constitute sufficient cause for rejection of the bid. In case of any discrepancy between words and figures in the price bid, the price as expressed in words shall govern. All bids must be submitted in sealed envelopes addressed to: **Ms. Ann Marie Rocco, Village Clerk, Village of Ardsley, 507 Ashford Avenue, Ardsley, NY 10502** and be clearly identified with: (1) Project Name, (2) Name of Bidder, (3) Bidder's address and (4) Contract Number being bid upon**. All Bids are to be delivered to**: **Village of Ardsley, 507 Ashford Avenue, Ardsley, NY 10502 no later than 11:00 AM on Thursday, May 5, 2022** and immediately thereafter the bids will be publicly opened and read aloud in the said office. **Any bids received after that time will not be accepted.** Bid Proposals shall be signed with the name typed or printed legibly below the signature. The Bidder's seal, if a corporation, shall be affixed under the Bidder's signature. Telephone or telegraphic bids will not be accepted.

   If separate sets of Bid Proposal sheets are issued, they may be used with the understanding that all instructions and conditions of the Contract Documents are the same as if these pages were bound therein.

   PREPARATION OF BID PROPOSAL

   A. Bid Proposals must be submitted upon the prescribed form, one copy of which is attached hereto. All blank spaces for bid prices must be filled in, in ink, in both words and figures. The Bidder shall submit as their bid one copy of the Bid Proposal Form, and keep a copy for their records. Bid Proposals shall consist of the following, filled-in and executed:

      - Bid Security
      - Bid Proposal Form
      - References
      - Bid Proposal Certifications (Non-Collusive Form and General Municipal Law §103-g(4) Form)
      - Statement of Bidder's Qualifications
      - Letter from Insurance Carrier verifying that Contractor meets Insurance Requirements as per bid specifications- C**ontractor Insurance requirements are as noted in General Conditions, Article 11 – Insurance & Bonds and Supplementary General Conditions, Section 000720.**
      - Certified letter from Bonding Company, indicating that they meet the minimum requirement required by the contract to be awarded and stating that it will provide the necessary Performance Bond and Labor and Material Payment Bond for the project being bid.

All bids must be submitted in sealed envelopes, bearing on the outside, the name of the Bidder, their address, the name of the project and Contract Number bid upon. Bid Proposals so enclosed shall be delivered on or before the date, time and at location stipulated above.

3. QUALIFICATIONS OF BIDDERS: The **Village of Ardsley, hereinafter referred to as the "Village** "may make such investigations as it deems necessary to determine the qualifications of the Bidder to perform the work, and the Bidder shall furnish information and data for this purpose as is required (see Statement of Bidders Qualifications). The **Village** reserves the right to reject any bid if the evidence submitted by a Bidder, or the investigation of such Bidder, fails to satisfy the **Village** that such Bidder is properly qualified to carry out the obligations of the contract to be awarded and to complete the work contemplated therein within the time designated. Fraudulent statements shall cause rejection of the subject bid and forfeiture of the related bid security.

   To be considered qualified, a Bidder must demonstrate to the **Village's** satisfaction:

   I. The Corporation, partnership, sole proprietorship or other business entity in whose name bid is submitted has been in business, continuously, for no less than the previous five (5) years performing or coordinating the Work which they are bidding on.
   II. The Bidder has satisfactorily completed no less than five (5) projects of comparable size and complexity to this project working in occupied recreational spaces as a Prime Contractor to a Project Owner.
   III. The Bidder is not currently involved in bankruptcy proceedings.
   IV. The Bidder is licensed to perform the Work they are bidding on in the jurisdiction in which the Work will take place.
   V. The Bidder is capable of and intends to perform at least 25% of the Work with their own forces.
   VI. The Bidder is able to perform the Work with the manpower available to them.
   VII. The Bidder and each of its sub-contractors must have five (5) years' experience in the Work and/or applicable trade.
   VIII. The successful Bidder's Field Superintendent must have at least five (5) years as a working field superintendent. The Field Superintendent shall speak fluent English or the successful Bidder shall supply an interpreter to be at the project site whenever the Field Superintendent is there at no additional cost to the Village.

4. CONDITIONS OF WORK: Each Bidder must inform themselves fully of all conditions under which the work will be performed. Failure to do so will not relieve a successful Bidder of its obligation to furnish all material and labor necessary to carry out the provisions of the contract to be awarded and to complete the work for the consideration set forth in its bid. Each Bidder's attention is directed to Paragraph 1 of the Bid Proposal, in which the Bidder certifies that they have examined the site. The Bid Proposal shall include the complete costs of furnishing all materials, labor and equipment necessary to complete the work in accordance with the Contract Plans and Specifications and all other expenses incidental thereto. Local and State sales taxes shall not be included in the bid. Insofar as possible, the successful Bidder, in carrying out the work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor, or of the proper functioning of the existing facilities of adjacent or contiguous properties, and shall be maintained insofar as possible.

5. ADDENDA AND INTERPRETATION:

   a. **ADDENDA:** Additions or deletions to the scope of work and supplemental Instructions to Bidders may be issued by the **Village** in the form of an ADDENDUM.

   b. **REQUESTS FOR INFORMATION AND INTERPRETATIONS:** Every request for information or interpretation of Specifications, Addenda, or Contract Drawings must be addressed in writing using the enclosed form in the Specifications (Section 000215) and emailed to the **Construction Manager, Calgi Construction Company, Inc. Email - dchen@calgiconstruction.com Attention: Mr. David Chen** and CC the Architect, Weston & Sampson, Email: **TenneyD@wseinc.com Attention: Mr. Daniel Tenney**

   To be given any consideration, all requests for information or interpretation must be received at least **seven (7) business days** prior to the date fixed for the opening of bids. Any and all such interpretations, and any supplemental instructions, will be issued in the form of written Addenda and will be E-Mailed to all prospective Bidders. The failure of any Bidder to receive any such Addenda will not relieve the Bidder of any obligation under his Bid as submitted. Any Addenda so issued shall become part of the Bidding Documents. Receipt of Addenda shall be noted on the "Bid Proposal Form."

6. BID SECURITY: Each Bidder is required to deposit, at the time of submission of their bid, a Bid Bond or certified check in an amount representing five (5%) percent of their bid, payable to **Village of Ardsley,** which amount the Bidder agrees is to be forfeited as liquidated damages and not as a penalty if the Bidder is awarded the contract and thereafter fails to execute a contract with the **Village of Ardsley** under the conditions of the Bidding Documents or to furnish the bonds required for the faithful performance of the awarded contract. Bidders who submit certified checks must accompany them with a Consent of Surety from a recognized bonding company agreeing to supply a Performance Bond and Labor and Materials Bond if the contract is awarded to the Bidder.

   Such bid security will be returned to all except the three lowest formal Bidders within three days after the formal opening of bids, and the remaining bid security will be returned to the other Bidders after the **Village** and the accepted Bidder have executed a contract. In the event no contract has been so executed within SIXTY (60) calendar days after the date of the opening of bids, upon the demand of the Bidder, so long as Bidder has not been notified of the acceptance of its bid, Bidder's security will be returned. The Bid Security of the successful Bidder will be retained until the signing of the awarded contract and the filing and approval of the bonds and insurance certificates.

7. INSURANCE REQUIRED: The successful Bidder will be required to procure and pay for the following types of insurance. **Contractor Insurance requirements are as noted in General Conditions, Article 11 – Insurance & Bonds and Supplementary General Conditions, Section 000710.**

   a. Commercial General Liability
   b. Statutory Workers Compensation
   c. Commercial Automobile Liability
   d. Umbrella Liability/Excess Liability
   e. Contractors Pollution Liability

8. SECURITY FOR FAITHFUL PERFORMANCE: **The successful Bidder shall, prior to execution of the awarded contract, submit executed bonds: (1) a Performance Bond in amount equal to one hundred percent (100%) of the accepted bid as security for the faithful performance of the terms, covenants and conditions of the awarded contract; and (2) a Labor and Materials Payment Bond for the full amount of the awarded contract price guaranteeing the full payment of all persons performing labor or furnishing materials or rentals under the awarded contract.**

   ~~**In addition, at the time of final payment, a two year (2) Maintenance Bond guaranteeing against defective materials and workmanship will be required in an amount equal to one hundred percent (100%) of the adjusted contract amount.** ***This Bond in no way removes the obligation of the successful Bidder to comply with furnishing the standard one (1) year guarantee / warranty as specified elsewhere in the Specifications.***~~

   The Bonds shall be prepared on standard AIA forms as follows: Performance Bond and Payment Bond shall be in accordance with the latest A.I.A. Document A-312. Bonds shall have as Surety thereon such Surety Company or companies as are acceptable to the **Village** and are authorized to transact business in the State of New York.

   ***All Bonding companies supplying bid, performance, payment and maintenance bonds are required to provide, with the bid package, the following required information. Bidders failing to provide this information will not be considered. Provide a certified statement that the bonding company meets or exceeds the following:***

   1. ***A.M. Best Company (Old Wick, New Jersey) Rating of A or better.***
   2. ***(FPR) Financial Performance Rating from A.M. Best of not less than VI.***
   3. ***Bonding Company must be registered to do business in New York State.***
   4. ***Listed in the U.S. Treasury Circular 570 (1994 or current version).***
   5. ***If underwriting limitation is less than the required performance bond amount, then the excess amount must be protected by co-insurance with a company meeting the same standards as above.***

9. FORM OF AGREEMENT: The form of agreement shall be the **Standard Form of Agreement Between Owner and Contractor,** Construction Manager as Advisor Edition, AIA Document A132- 2009, modified to conform to the Bidding Documents.

10. AWARD:

    a) Contract award will be made to the lowest responsible Bidder to be determined at the **Village's** discretion as follows:

       i. 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 therefore is the lowest.
       ii. If the award is to be made on the basis of a combination of Base Bids with Alternates, it may be made to that responsible Bidder, whose net bid on such combination is the lowest, using such Alternates as selected by the Owner.

    b) The **Village** reserves the discretionary right to waive what it deems to be informalities relating to a specific bid, to waive what it deems to be technical defects, irregularities and omissions relating to a specific bid, and to request additional information from any Bidder.

c) The **Village** reserves the discretionary right to reject any or all bids within sixty (60) days of bid opening, if in its opinion the best interest of the District will thereby be promoted, and to advertise for new bids.

11. OWNER: **Village of Ardsley of the County of Westchester in the State of New York.**

12. SALES TAX EXEMPTION: Under Chapter 513 of the Laws of New York 1974, all materials and supplies sold to a contractor and which are to become an integral, component part of a structure, building or real property owned by an exempt organization such as the **Village of Ardsley** are exempt from the payment of New York State Sales and Compensatory Use taxes. Therefore, Bidders should not include any amount in their bid price to cover sales taxes for the above items.

13. REQUIRED SUBMISSIONS: Prior to award, the successful Bidder will be required to meet the following requirements:

    a. The successful Bidder, if their business is not registered in New York State, must provide the **Village** with a certificate issued by the Secretary of State of New York stating that the Corporation is authorized to do business within the State and is presently in good standing. If the entity to whom the bid is awarded is not a corporation, it would be required that the entity's certificate of doing business, which should be on file in the County Clerk's Office, Westchester County, be provided. (This would also hold true in the case of joint ventures which would be required to disclose the underlying entities which make up the joint venture and the supplying of the requisite certificate of doing business of each such entity.)

    b. A statement by the successful Bidder that no officer, director or stockholder of the successful Bidder is an officer or employee of the **Village** or is a relative of any such **Village** officer or employee. If such officer, director or stockholder does exist, their names and relationship shall be disclosed to the **Village**.

    c. The successful Bidder shall submit the following, in a form acceptable to the **Village**, for approval before being permitted to start work:

        i. Signed Contract
        ii. Certificates of Insurance
        iii. Labor and Material Payment Bond
        iv. Performance Bond
        v. *Schedule of Values**
        vi. Construction Schedule
        vii. Submittal Schedule

    ***The Schedule of Values included as part of the Bid Proposal is for the purpose of bid evaluation only. The Schedule of Values referenced here as item* v. *is the one that will accompany the Contractor's Payment Requisition form and must be reviewed and approved by the Architect and Construction Manager before the first payment requisition is submitted.*

~~14. APPRENTICES PROGRAM: See Appendix 'A', Page IB-8 of 8~~

15. AFFIRMATIVE ACTION REQUIREMENTS: The Bidder agrees and warrants that in the performance of the contract to be awarded, the Bidder will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, disability, age, sex, religion or national origin in any manner prohibited by the laws of the United States, New York State, County of Westchester and further agrees to provide any information that may be requested by the **Village** or it's Consultants or any Governmental

Agency concerning practices and procedures of the Bidder as related to the provisions of this section.

16. CERTIFIED PAYROLL: The successful Bidder will be required to submit a certified payroll certificate with each monthly payment requisition.

17. SITE SUPERVISION: THE SUCCESSFUL BIDDER IS TO PROVIDE FULL TIME SITE SUPERVISION FOR HIS OR HER STAFF, SUBCONTRACTORS AND SUPPLIERS FOR THE DURATION OF THIS PROJECT. A competent superintendent shall be in attendance at the job site at all times when work is being performed under the contract to be awarded. A qualified site superintendent must have the authority to represent and make decisions for his or her company with regards to the subject job, must be able to give guidance and direction to employees, subcontractors and suppliers, and must be knowledgeable about the work to be provided. FAILURE TO PROVIDE A QUALIFIED SITE SUPERINTENDENT AT THE JOB SITE SHALL SUBJECT THE SUCCESSFUL BIDDER TO A PENALTY OF **$500 PER DAY FOR EVERY OCCURRENCE**.

18. LIQUIDATED DAMAGES FOR FAILURE TO COMPLETE THE PROJECT ON TIME: By submitting a Bid Proposal, Bidders recognize and agree that time is of the essence on the contract to be awarded and the date of Substantial Completion shall be no later than the date indicated in the Contract Documents. In the event the successful Bidder fails to substantially complete the work under the awarded contract by said scheduled date, each Bidder agrees liquidated damages of $1,000.00 per calendar day will be subtracted from the payment due the successful Bidder as follows:

    **Liquidated damages of $1,000.00 per day** beginning on the fifth calendar day after the substantial completion dates listed, except in cases where a delay is due to unforeseeable causes beyond the control and without the fault or negligence of the successful Bidder including, acts of God, or of a public enemy, acts of the Government, in either its sovereign or contractual capacity, fire, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of Subcontractors or Suppliers due to such causes. Delay in acquisition of materials other than by reason of strike or freight embargoes will not constitute a delay excusable under this provision unless approved by the **Village** in writing.

    Within five calendar days from the occurrence of any such delay, the successful Bidder shall notify the **Village** in writing of the cause of delay. The **Village** will ascertain the facts and extent of the delay, and extend the time for completing the Work when in the judgment of the **Village's** Architect and Construction Manager the findings of fact justify such an extension. The **Village's** findings of fact will be final and binding.

    The said sum of $1,000.00 per calendar day shall constitute the Liquidated Damages incurred by the **Village** 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, which the **Village** may incur as a result of the successful Bidder's breach of contract.

    In the event the successful Bidder fails to complete all work under the awarded contact by said scheduled dates and the Village has taken occupancy, the successful Bidder will not be permitted to perform any work during normal business hours. Such work shall only be performed after the Village's business hours, Saturdays, Sundays, holidays or periods when the facility is unoccupied, and at no additional cost to the Owner.

    In addition to Liquidated Damages, the successful Bidder shall be liable for all additional costs incurred by the Village to: provide staff required to make the facility accessible to the successful Bidder, the Architect, their Consultants and the Construction Manager as required to perform inspections after the completion date of the awarded contract. (Inspections will be performed on a regular basis, during construction by the Architect, their Consultants and Construction Manager. The same schedule will be

followed in the event that the completion date of the awarded contract is not met, unless the Village, their Architect and Construction Manager determine, at their sole discretion, that additional inspections are needed.)

All costs incurred by the Village, and the cost of additional Architectural and Construction Manager inspections, will be subtracted from payment due the successful Bidder (or, if the amount due the successful Bidder for payment is insufficient, any deficiency shall be paid by the successful Bidder to the Village).

19. OBLIGATION OF BIDDERS:

    A. At the time of the opening of bids, each Bidder will be presumed to have inspected the site and to have examined and to be thoroughly familiar with the Contract Drawings, General Conditions, General Requirements of the contract to be awarded, and Specifications (including all Addenda thereto). Each Bidder will also be presumed to be familiar with the scope and schedule of other projects that maybe concurrently scheduled at the project site. The failure of or omission of any Bidder to receive or examine any Contract Drawings, form, instruction or document shall in no way relieve any Bidder from any obligation in respect to its bid.

    B. Each Bidder shall, by careful examination of the site, satisfy themselves as to the location of the work, the character, the quality and quantity of the work to be performed and materials to be furnished, the character of equipment and facilities needed preliminary to and during prosecution of the work, the general and local conditions and all other matters which in any way affect the work specified in the Contract Documents.

    C. After the contract has been awarded, no consideration will be given for any misunderstanding as to the work and materials set forth in the Contract Documents and shown on any of the accompanying Contract Drawings, details or schedules, it being mutually understood that the tender of a bid carries with it an agreement to this and other obligations set forth in the Contract Documents, including but not limited to Specifications, Contract Drawings and details, noted indications and requirements.

    D. Each Bidder should review the State of New York Department of Labor Schedules of the prevailing hourly wage rates, the prevailing hourly supplements, and the requirements for all Contractors and Subcontractors engaged on public work projects in New York State.

    E. It is the intention of the Contract Documents, including but not limited to Specifications and Contract Drawings, to provide for a complete, key-in- lock job under each particular prime contract. The bid should therefore include all items of labor and materials, including all patching and repair work necessary even though such items may not be specifically noted to complete finished job.

    F. During the bidding and construction process, each Bidder is responsible for reading all Contract Drawings and all Specification sections and performing any work which falls under the Bidder's trade. Each Bidder is also responsible to be familiar with the Contract Drawings and Specifications of the work of the other contractors at work on this project.

20. RETAINAGE: The successful Bidder's application for payment will be based on a 5% (five percent) retainage. The 5% retainage shall be retained until final acceptance of the project, at which time the retainage shall be released upon submission of required close-out documents.

21. SITE INSPECTION: See Notice to Bidders for scheduled pre-bid meeting.

22. SUBMITTALS: All long lead items shall be submitted within ten (10) working days of the start of work. Refer to Specifications for additional requirements.

23. VILLAGE'S TIME AND DAMAGE CLAIMS:

A. Any time or expenses incurred by the **Village's** Architect, the Architect's Consultants and Construction Manager as a result of the successful Bidder's activities, unless otherwise specifically agreed to in writing by the Village, will be back-charged to the successful Bidder.

B. Overtime rates as follows:

| C. | Weekdays: 6:00pm to 6: 00 am<br>All day Saturday | Sundays, Holidays<br>All day |
|---|---|---|
| Architect | $ 215.00 /hour | $275.00 /hour |
| Civil Engineer | $ 200.00 /hour | $250.00 /hour |
| Structural Engineer | $ 135.00 /hour | $175.00 /hour |
| MEP Engineer | $ 175.00 /hour | $200.00 /hour |
| Construction Manager | $ 175.00 /hour | $175.00 /hour |

D. Except when deemed an emergency or specialty service (i.e.: fire or security alarm) by the **Village**, the successful Bidder will be given written notice concerning required repairs to damages caused by the successful Bidder's activities. If the damages are not corrected to the **Village's** satisfaction and per the **Village's** time frame, the **Village** will make the corrections and back-charge the successful Bidder accordingly via a reduction in the amount of the awarded contract.

24. PROJECT CLOSE-OUT INSPECTION PROCEDURES: Upon receipt of a request for an inspection or on the date scheduled for substantial completion, whichever comes first, the Architect and Construction Manager will conduct an inspection and issue a list of all incomplete and/or defective work that must be completed or corrected before a Certificate of Substantial Completion will be issued.

The successful Bidder shall complete all remaining work and punch list items within twenty one (21) calendar days of receipt of the Punch List. Should the successful Bidder fail to complete the work as described herein, the **Village** may without further delay, terminate the awarded contract, withhold all further payments, and complete the work to the Village 's convenience deducting all costs to administer, perform and inspect the completion of the work from the balance due upon the awarded contract.

The Architect and Construction Manager will conduct one re-inspection at the completion of all punch list items, when requested and assured that the Work has been completed by the successful Bidder. If the work has not been completed by the successful Bidder, the cost to perform subsequent inspections by the Architect and Construction Manager will be subtracted from payment due the successful Bidder (or, if the amount due the successful Bidder is insufficient, any deficiency shall be paid by the successful Bidder to the Village).

Final acceptance of the work and approval of final payment will occur only after the Architect has conducted an inspection/re-inspection to verify the work is complete and adequate.

END OF SECTION 00 21 12

CALGI
Established 1919

CONSTRUCTION MANAGEMENT
OWNER'S REPRESENTATIVE
CONSULTING
GENERAL CONTRACTING

CALGI CONSTRUCTION COMPANY, INC.
56 Lafayette Avenue, Suite 350
White Plains, New York 10603
TEL: 914-682-9423
FAX: 914-682-9420
www.calgiconstruction.com

# FAX TRANSMITTAL

**TO:** **David Chen**

**FROM:**

**CC:** **Architect**

**DATE:**

**RE:** **Village of Ardsley –New DPW**

***THIS FAX, INCLUDING THE COVER SHEET; CONSISTS OF _____ PAGES. PLEASE CALL IF ANYTHING IS MISSING OR INCOMPLETE.***

**(PAGE INTENTIONALLY LEFT BLANK)**

SECTION 00 04 16
FORM OF PROPOSAL

1.1 INFORMATION

A. Bid presented to: Village of Ardsley, 507 Ashford Avenue, Ardsley, NY 10502.

B. Bid presented by:

**a. Legal name and address of Bidder:** _____
_____
_____

C. Bid presented for: New Public Works Facility, Ardsley, NY:

| TRADE | CONTRACT NO. | CHECK ONE |
|---|---|---|
| **(GCC)** General Construction | 1811-001 | |
| **(PC)** Plumbing Construction | 1811-002 | |
| **(FSC)** Fire Protection Systems Construction | 1811-003 | |
| **(MC)** Mechanical Construction | 1811-004 | |
| **(EC)** Electrical Construction | 1811-005 | |

D. The bidder by making a bid represents that:

a. The Bidder has read and understands the Bidding Documents titled New Public Works Facility, Village of Ardsley and the Bid is made in accordance therewith;

b. The Bidder has read and understands the Bidding Documents and Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction;

c. The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidders personal observations with the requirements of the proposed Contract Documents;

d. The Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception.

E. Addenda:

a. The Bidder acknowledges receiving all Addenda and including their provisions in the Bid.

**b.** Indicate the Addenda numbers received:_____

F. Bid:

a. The Bidder proposes to perform the Work for the following lump sum amount:

BASE BID: $_____ (Numerical amount)

(_____Dollars) (Written amount)

G. Complete the following applicable page(s) and the final page "Execution" paragraph:

H. Alternates:

a. GC, FSC, EC - Alternate No. 1: ADD - Mezzanine:

ADD: $_____

b. GC, EC - Alternate No. 2: ADD – Fueling Station:

ADD $_____

c. GC, EC - Alternate No. 2a: ADD – Fueling Station Canopy:

ADD $_____

d. GC, PC, FSC, MC, EC - Alternate No. 3: DEDUCT Storage Basement & Shop Extension:

DEDUCT $_____

e. GC, EC - Alternate No. 4: ADD – 5 Ton Bridge Crane:

ADD $_____

f. GC, PC - Alternate No. 5: ADD – Fluid Distribution System:

ADD $_____

g. GC, EC - Alternate No. 6: ADD Generator:

ADD $_____

h. GC - Alternate No. 7: ADD – Parts Storage Shelving & Workbenches:

ADD $_____

i. (MC, EC) - Alternate No. 8: DEDUCT – Building Management System (BMS):

DEDUCT $_____

I. General Construction No. 1:

1. Unit Prices (only applicable unit prices are listed):

| Unit Price No. | Item | Unit of Measure | Unit Price Add | Unit Price Deduct |
|---|---|---|---|---|
| 1 | Trench Rock Excavation | Cubic Yard | | |
| 2 | Bulk Rock Excavation | Cubic Yard | | |
| 3 | Exterior Bulk Excavation | Cubic Yard | | |
| 4 | Exterior Trench and Culvert Excavation | Cubic Yard | | |
| 5 | Replacement of Unsuitable On-Site Materials | | | |
| 6 | Utilities Excavation | Linear Foot | | |
| 7 | Cast-In-Place Concrete | Cubic Yard | | |
| 8 | Concrete Slab-On-Grade | Square Foot | | |
| 9 | Concrete Slab-On-Metal Deck | Square Foot | | |
| 10 | Structural Steel | Pounds | | |
| 11 | Metal Decking | Per lbs or SF | | |
| 12 | Access Door & Frame at GWB Wall or Ceiling | Installed per door | | |
| 13 | Fire Access Door & Frame at GWB Wall or Ceiling | Installed per door | | |

2. Allowances: There are no allowances as part of this Base Bid.

3. Schedule of Values *(for Bid Evaluation Only):* General Construction Contract #1 Base Bid

| Description of Work | Price | Description of Work | Price |
|---|---|---|---|
| General Conditions | | Firestopping, Sealants and Caulking | |
| Bonds and Insurance | | Aluminum Windows and Curtainwall | |
| Mobilization/Temporary Facilities | | Translucent Panel | |
| Building Demolition | | Interior Glass and Glazing | |
| Hazmat Abatement | | Hollow Metal Frames and Doors | |
| Site Work | | Aluminum Frames and Doors | |
| Survey/Shop Drawings | | Hardware | |
| Cutting and Patching | | Access Doors | |
| Concrete Foundations | | Drywall & Accessories | |
| Concrete Slabs | | Acoustical Ceilings | |
| Masonry | | Finish Flooring (carpet, vct, etc) | |
| Metal Fabrications | | Ceramic Tile (Floors, Base & wall) | |
| Roofing & Roof Specialties | | Painting | |
| Rough Carpentry | | Specialties – Division 10 | |

| | | | |
|---|---|---|---|
| Millwork | | Equipment- Division 11 | |
| Finish Carpentry | | Furnishings – Division 12 | |
| Insulation and Waterproofing | | Special Construction - Division 13 | |
| Roofing Access. & Sheet Metal | | Conveying System | |
| | | | |
| | | **Total (must be equal to bid base price)** | |

J. Plumbing Contract No. 2:

1. Unit Prices (only applicable unit prices are listed):

| Unit Price No. | Item | Unit of Measure | Unit Price Add | Unit Price Deduct |
|---|---|---|---|---|
| | FIXTURES: | Each | | |
| | Water Closet | Each | | |
| | Urinal | Each | | |
| | Lavatory | Each | | |
| | Drinking Fountain | Each | | |
| | Mop Sink Basin | Each | | |
| | Floor Drain | Each | | |
| | Roof Drain | Each | | |
| | Wall Hydrant | Each | | |
| | Hose Bibb | Each | | |
| | Emergency Eye Wash | Each | | |
| | RPZ Assembly | Each | | |
| | General Laborer | Straight time/OT | | |
| | Plumber | Straight time/OT | | |
| | Insulator | Straight time/OT | | |

2. Allowances: There are no allowances in the Base Bid:
3. Schedule of Values (for Bid Evaluation Only): Plumbing Contract #2 Base Bid

| Description of Work | Price | Description of Work | Price |
|---|---|---|---|
| General Conditions | | Water Heaters | |
| Bonds and Insurance | | Plumbing Identification | |
| Mobilization/Temporary Facilities | | Emerg. Shower/Eye Wash Equipment | |
| Shop Drawings | | Equipment Pads & Supports | |
| Cutting and Patching | | Trenching/Backfill | |
| Pipe and Fittings | | Punchlist | |
| Fixtures | | Close-out | |
| Insulation | | Others (specify below): | |
| Access Doors | | | |
| Storm Water Piping | | Overhead & Profit | |
| Sanitary Waste & Vent Piping | | | |

| | | | |
|---|---|---|---|
| Cold, Hot & Recirculation Piping | | | |
| | | | |
| | | **Total (must be equal to bid base price)** | |

K. Fire Protection Systems Contract No. 3:

1. Unit Prices (only applicable unit prices are listed):

| Unit Price No. | Item | Unit of Measure | Unit Price Add | Unit Price Deduct |
|---|---|---|---|---|
| | Pendant Concealed Sprinkler Head | Each | | |
| | Pendant Exposed Sprinkler Head | Each | | |
| | Upright Sprinkler Head | Each | | |
| | Sidewall Sprinkler Head | Each | | |
| | Tamper Switch | Each | | |
| | Flow Switch | Each | | |
| | General Laborer | Straight time/OT | | |
| | Steamfitter | Straight time/OT | | |
| | Insulator | Straight time/OT | | |

2. Allowances: There are no allowances in the Base Bid:
3. Schedule of Values (for Bid Evaluation Only): Fire Protection Contract #3 Base Bid

| Description of Work | Price | Description of Work | Price |
|---|---|---|---|
| General Conditions | | Access Doors | |
| Bonds and Insurance | | Sprinkler Systems | |
| Mobilization/Temporary Facilities | | Equipment Pads & Supports | |
| Shop Drawings | | Trenching/Backfill | |
| Cutting and Patching | | Punchlist | |
| Pipe and Fittings | | Close-out | |
| Fixtures | | Others (specify below): | |
| Insulation | | | |
| | | Overhead & Profit | |
| | | | |
| | | **Total (must be equal to bid base price)** | |

L. Mechanical Contract No. 4:

1. Unit Prices (only applicable unit prices are listed):

| Unit Price No. | Item | Unit of Measure | Unit Price Add | Unit Price Deduct |
|---|---|---|---|---|
| | Galvanized Ductwork | Pounds | | |
| | Plenum Ductwork | Pounds | | |
| | Fire-Smoke Damper | Square Foot | | |

| | | | | |
|---|---|---|---|---|
| | Volume Damper | Each | | |
| | 100-500cfm Fancoils | Each | | |
| | Unit Heater | Each | | |
| | Condensate Pump | Each | | |
| | Thermostat | Each | | |
| | Relay | Each | | |
| | Temperature Sensor | Each | | |
| | Control Valve (1/2” to 4”) | Each | | |
| | Motorized Damper | Each | | |
| | General Laborer | Straight time/OT | | |
| | Steamfitter | Straight time/OT | | |
| | Sheet Metal Mechanic | Straight time/OT | | |
| | Insulator | Straight time/OT | | |
| | Controls Technician | Straight time/OT | | |
| | Draftsperson | Straight time/OT | | |
| | Diffuser, Grille | Each | | |
| | Roof Penetration to 2sf | Each | | |
| | Housekeeping Pad | Straight time/OT | | |
| | Roof Curb | Each | | |

2. Allowances: There are no allowances in the Base Bid:
3. Schedule of Values (for Bid Evaluation Only): Mechanical Protection Contract #4 Base Bid

| Description of Work | Price | Description of Work | Price |
|---|---|---|---|
| Bonds and Insurance | | Heat Exchangers. | |
| Mobilization/Temporary Facilities | | Starters | |
| Shop Drawings | | Sound Traps | |
| Cutting and Patching | | Painting & Identification | |
| Radiation & Convectors | | Chemical Treatment | |
| Pumps and Equipment | | Refrigerant Monitoring Sys-tem | |
| Cabinet/Unit Heaters | | Equipment Pads & Supports | |
| Access Doors | | Trenching/ Backfill | |
| Ductwork and Accessories | | Punchlist | |
| Insulation | | Close-out | |
| Registers, Grilles & VAV Boxes | | Others (specify below) | |
| Controls and Instrumentation | | | |
| Testing, Adjusting & Balancing | | | |
| Pipes, Fittings & Hangers -Chilled | | Overhead & Profit | |
| Pipes, fittings, and hangers | | | |
| Chilled and Hot Water | | | |
| Air Handlers, Fans, and Unit | | | |
| | | | |
| | | **Total (must be equal to bid base price)** | |

M. Electrical Contract No. 5:

1. Unit Prices (only applicable unit prices are listed):

| Unit Price No. | Item | Unit of Measure | Unit Price Add | Unit Price Deduct |
|---|---|---|---|---|
| | Duplex Receptacle | Each | | |
| | Line Voltage Lighting Switch | Each | | |
| | Low Voltage Lighting Switch | Each | | |
| | Vacancy Sensor | Each | | |
| | Light Fixture (each type) | Each | | |
| | Empty Conduit & Junction Box for Telecommunications | Per Drop | | |
| | Card Reader | Each | | |
| | Smoke Detector | Each | | |
| | Pull Station | Each | | |
| | Tamper Switch | Each | | |
| | Door Holder | Each | | |
| | Horn/Strobe | Each | | |
| | Heat Detector | Each | | |
| | Fire Alarm Control Module | Each | | |
| | Branch Circuit 2#12,1#12G-¾” C | Per 20 Feet | | |
| | 2#10,1#10G-¾” C | Per 20 Feet | | |
| | 4#10, 1#10G-3/4” C | Per 20 Feet | | |
| | 5#10, 1#10G-3/4” C | Per 20 Feet | | |
| | Feeder | Linear Foot | | |
| | 4#4,1#8G-1 ¼ ” C | Linear Foot | | |
| | 3#2,1#6G-2” C | Linear Foot | | |
| | 4#4/0,1#2G-2.5”C | Linear Foot | | |
| | 4#500mcm,1#350mcmG-3½” C | Each | | |
| | 20A-1p breaker | Each | | |
| | 30A-1p breaker | Each | | |
| | 20A-2p breaker | Each | | |
| | 30A-2p breaker | Each | | |
| | 60A-3p breaker | Each | | |
| | 80A-3p breaker | Each | | |
| | 100A-3p breaker | Each | | |
| | 150A-3p breaker | Each | | |
| | 225A-3p breaker | At 550 Feet | | |
| | Difference between 2#8, 1#10G and 2#4, 1#8G | Linear Foot | | |
| | Fire Alarm Branch Wiring | Each | | |
| | 30A-3p Fused Disconnect Switch | Each | | |
| | 60A-3p Fused Disconnect Switch | Each | | |
| | 100A-3p Fused Disconnect Switch | Each | | |
| | 200A-3p Fused Disconnect Switch | Each | | |
| | 300A-3p Fused Disconnect Switch | Each | | |

2. Allowances : There are no allowances in the Base Bid:

3. Schedule of Values *(for Bid Evaluation Only):* Mechanical Contract #5 Base Bid

| Description of Work | Price | Description of Work | Price |
|---|---|---|---|
| General Conditions | | Fire Alarm | |
| Bonds and Insurance | | Motor Controls | |
| Mobilization/Temporary Facilities | | Lighting | |
| Shop Drawings | | Equipment Pads & Supports | |
| Cutting and Patching | | Trenching/Backfill | |
| Temporary Lighting & Power | | Punchlist | |
| Electrical Service | | Close-out | |
| Electrical Devices | | Others(specify beow): | |
| Conduit & Electrical Boxes | | | |
| Wiring | | Overhead and profit | |
| Panel Boards & Switches | | | |
| | | **Total (must be equal to bid base price)** | |

N. EXECUTION

1. The undersigned Bidder will accomplish all work required by the Bidding Documents and will provide Substantial Completion within 335 calendar days from the Contract signing, and will provide the Project, ready for final acceptance, inclusive of all Punch List and Project Close Out Documents within 365 calendar days from the Contract signing.
2. The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work.
3. Enclosed herewith, is the Bid Security in the form of:

   Bid Bond( ) Certified Check ( )

   in the amount of _____ Dollars.

Indicate if the Bidder is a sole proprietor, partnership, corporation, or other legal entity.

_____

Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

Bidder's signature: _____

Title: _____

Date:_____

SEAL (if bid is a corporation)

Acknowledgement by Contractor, if a corporation.

State of New York
County of:
_____

On this ____ day of _____, 2022, before me personally came
_____._____,
to me know and known and known to me, who, being sworn, did depose and say that he/she resides in the
_____:
that he/she is the of the _____,
a body corporate and the corporation described in and which erected the foregoing instruments; that he/she know the seal of said corporation; that the seal affixed to said instrument is such corporate seal; and that it was so affixed by order of said corporation; and that he/she signed his name thereto by like order.

NOTARY PUBLC:_____

Seal

SECTION 00 04 17
NON-COLLUSION BIDDING CERTIFICATION

By submission of this bid or proposal, the bidder certifies that:

1. The bid has been arrived at by the bidder independently and has been submitted without collusion with any other vendor of materials, supplies, or equipment of the type described in the invitation for bids.

2. The contents of the bid have not been communicated by the bidder, nor, to its best knowledge and belief, by any of its employees or agents, to any person not an employee or agent of the bidder or its surety of any bond furnished herewith prior to the official opening of the bid.

3. No attempt has been or will be made to induce any other person, partnership or corporation to submit or not to submit a bid or proposal.

4. The person signing this bid or proposal certifies that he has fully informed himself regarding the accuracy of the statements contained in this certification, and under the penalties of perjury, affirms the truth thereof, such penalties being applicable to the bidder as to the person signing in its behalf.

5. That attached hereto (if corporate bidder) is a certified copy of resolution authorizing the execution of this certificate by the signator of this bid or proposal in behalf of the corporate bidder.

(Seal)

If a Corporation
It is incorporated in the State of New York?

If not, has a certificate of doing business been filed in the Office of Secretary of State?

Declaration made this _____ day of _____ ,20__ _____ , by:

Bidder: _____

Address: _____

Signed by: _____ Title: _____

Print Name: _____

STATE OF NEW YORK )
) ss:
COUNTY OF WESTCHESTER)

On this _____ day of _____, 20 __, before me personally came and appeared

_____, to me known, and who executed the foregoing instrument.

**NOTARY PUBLIC**

_____

**(PAGE INTENTIONALLY LEFT BLANK)**

**SECTION 00 04 18**

**General Municipal Law §103-g(4) Certification**

Pursuant to New York State Finance Law §165-a, the Commissioner of General Services is required to develop a list of persons it determines engage in investment activities in Iran, which is defined as provision of goods, services or credit of $20,000,000 or more, relating to the energy sector.

New York General Municipal Law §103-g(4) requires that every bid made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required contain the following statement subscribed by the Bidder and affirmed by such Bidder as true under penalties of perjury.

The below signed Bidder affirms the following as true under penalties of perjury:

> 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 that each Bidder is not on the list created pursuant to paragraph (b) of subdivision 3 of Section 165-a of the state finance law.

If the below signed Bidder cannot make the foregoing certification, the Bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefor.

_____
Corporate or Company Name

(Seal of Corporation)

By: _____
Signature

_____
Title

Sworn to before me this

_____day of _____, 20___

_____
Notary Public
My Commission expires:

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# AIA® Document A310™ – 2010

## Bid Bond

**CONTRACTOR:**
*(Name, legal status and address)*

**SURETY:**
*(Name, legal status and principal place of business)*

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.

**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.

Signed and sealed this day of

| | | |
|---|---|---|
| | *(Contractor as Principal)* | *(Seal)* |
| *(Witness)* | | |
| | *(Title)* | |
| | *(Surety)* | *(Seal)* |
| *(Witness)* | | |
| | *(Title)* | |

**CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.**

Init.
/

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# AIA® Document A310™ – 2010 Instructions

## *Bid Bond*

### GENERAL INFORMATION

**Purpose.** AIA Document A310™–2010 establishes the maximum penal amount that may be due the Owner if the Bidder fails to execute the contract and to provide the required performance and payment bonds, if any. It provides assurance that, if a bidder is offered a contract based on its tendered proposal but fails to enter into the contract, the Owner will be paid the difference in cost to award the contract to the next qualified bidder, so long as the difference does not exceed the maximum penal amount of the bond.

**Related Documents.** A310 is not incorporated by reference into other AIA documents. For further reference on bonding procedures, see AIA Document A701™–1997, Instructions to Bidders; and AIA Document G612™–2001, Owner's Instructions to Architect.

**Use of Non-AIA Forms.** AIA Document A310 may be used with any appropriate AIA or non-AIA document. CAUTION SHOULD BE EXERCISED BEFORE ITS USE TO VERIFY ITS COMPLIANCE WITH CURRENT LAWS AND REGULATIONS BY CONSULTING WITH AN ATTORNEY OR A BOND SPECIALIST.

### USING A310–2010

**Modifications.** Particularly with respect to professional or contractor licensing laws, building codes, taxes, monetary and interest charges, arbitration, indemnification, format and font size, AIA Contract Documents may require modification to comply with state or local laws. Users are encouraged to consult an attorney before completing or modifying a document.

In a purchased paper AIA Contract Document, necessary modifications may be accomplished by writing or typing the appropriate terms in the blank spaces provided on the document, or by attaching Supplementary Conditions, special conditions or referenced amendments.

Modifications directly to purchased paper AIA Contract Documents may also be achieved by striking out language. However, care must be taken in making these kinds of deletions. Under NO circumstances should standard language be struck out to render it illegible. For example, users should not apply blocking tape, correction fluid or Xs that would completely obscure text. Such practices may raise suspicion of fraudulent concealment, or suggest that the completed and signed document has been tampered with. Both parties should initial handwritten changes.

Using AIA software, modifications to insert information and revise the standard AIA text may be made as the software permits.

By reviewing properly made modifications to a standard AIA Contract Document, parties familiar with that document can quickly understand the essence of the proposed relationship. Commercial exchanges are greatly simplified and expedited, good faith dealing is encouraged, and otherwise latent clauses are exposed for scrutiny.

AIA Contract Documents may not be retyped or electronically scanned. Retyping can introduce typographic errors and cloud legal interpretation given to a standard clause. Furthermore, retyping and electronic scanning are not permitted under the user's limited license for use of the document, constitute the creation of a derivative work and violate the AIA's copyright.

**Identification of the Parties.** The Contractor, the Surety, and the Owner should be identified using their respective full names and addresses or legal titles under which the bond is to be executed. The state in which the Surety is incorporated also should be identified in the space provided.

**Bond Amount.** The dollar amount of the bond should be provided in both written and numerical form.

**Project Description.** The proposed project should be described in sufficient detail to identify (1) the official name or title of the facility; (2) the location of the site; (3) the proposed building type, size, scope or usage; and (4) the project number required by the owner, if any. A project number may be required by certain public owners to adequately identify the project to which the bond pertains.

**Execution of the Bond.** The bond must be signed by both the Contractor and the Surety. The parties executing (signing) the bond should print their title and impress their corporate seal, if any. Where appropriate, attach a copy of the resolution or bylaw authorizing the individual to act on behalf of the firm or entity. As to the Surety, this usually takes the form of a power of attorney issued by the Surety company to the bond producer (agent) who signs on its behalf.

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072510ACD43

# AIA® Document A305™ – 1986

## *Contractor's Qualification Statement*

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

**SUBMITTED TO:**

**ADDRESS:**

**SUBMITTED BY:**

**NAME:**

**ADDRESS:**

**PRINCIPAL OFFICE:**

[ ] Corporation

[ ] Partnership

[ ] Individual

[ ] Joint Venture

[ ] Other

**NAME OF PROJECT:** *(if applicable)* Calgi Construction

**TYPE OF WORK:** *(file separate form for each Classification of Work)*

[ ] General Construction

[ ] HVAC

[ ] Electrical

[ ] Plumbing

[ ] Other: *(Specify)*

**§ 1. ORGANIZATION**

**§ 1.1** How many years has your organization been in business as a Contractor?

**§ 1.2** How many years has your organization been in business under its present business name?

**§ 1.2.1** Under what other or former names has your organization operated?

**§ 1.3** If your organization is a corporation, answer the following:

**§ 1.3.1** Date of incorporation:

**§ 1.3.2** State of incorporation:

**§ 1.3.3** President's name:

**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.

This form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

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**User Notes:** (862550602)

**§ 1.3.4** Vice-president's name(s)

**§ 1.3.5** Secretary's name:
**§ 1.3.6** Treasurer's name:

**§ 1.4** If your organization is a partnership, answer the following:
**§ 1.4.1** Date of organization:
**§ 1.4.2** Type of partnership (if applicable):
**§ 1.4.3** Name(s) of general partner(s)

**§ 1.5** If your organization is individually owned, answer the following:
**§ 1.5.1** Date of organization:
**§ 1.5.2** Name of owner:

**§ 1.6** If the form of your organization is other than those listed above, describe it and name the principals:

**§ 2. LICENSING**
**§ 2.1** List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

**§ 2.2** List jurisdictions in which your organization's partnership or trade name is filed.

**§ 3. EXPERIENCE**
**§ 3.1** List the categories of work that your organization normally performs with its own forces.

**§ 3.2** Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)
**§ 3.2.1** Has your organization ever failed to complete any work awarded to it?

**§ 3.2.2** Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

**§ 3.2.3** Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

**§ 3.3** Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

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**User Notes:** (862550602)

**§ 3.4** On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

**§ 3.4.1** State total worth of work in progress and under contract:

**§ 3.5** On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

**§ 3.5.1** State average annual amount of construction work performed during the past five years:

**§ 3.6** On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

**§ 4. REFERENCES**

**§ 4.1** Trade References:

**§ 4.2** Bank References:

**§ 4.3** Surety:

**§ 4.3.1** Name of bonding company:

**§ 4.3.2** Name and address of agent:

**§ 5. FINANCING**

**§ 5.1** Financial Statement.

**§ 5.1.1** Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

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Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

**§ 5.1.2** Name and address of firm preparing attached financial statement, and date thereof:

**§ 5.1.3** Is the attached financial statement for the identical organization named on page one?

**§ 5.1.4** If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

**§ 5.2** Will the organization whose financial statement is attached act as guarantor of the contract for construction?

**§ 6. SIGNATURE**

**§ 6.1** Dated at this day of

Name of Organization:

By:

Title:

**§ 6.2**

M being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this day of

Notary Public:

My Commission Expires:

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**User Notes:** (862550602)

# AIA® Document A312™ – 2010

## *Performance Bond*

**CONTRACTOR:**
*(Name, legal status and address)*

**SURETY:**
*(Name, legal status and principal place of business)*

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.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

**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:

**SURETY**
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

*(Any additional signatures appear on the last page of this Performance 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 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 | | SURETY | |
|---|---|---|---|
| Company: | *(Corporate Seal)* | Company: | *(Corporate Seal)* |
| Signature: | | Signature: | |
| Name and Title: | | Name and Title: | |
| Address | | Address | |

**CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.**

# AIA® Document A312™ – 2010

## *Payment Bond*

**CONTRACTOR:**
*(Name, legal status and address)*

**SURETY:**
*(Name, legal status and principal place of business)*

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.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

**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 18

**CONTRACTOR AS PRINCIPAL**
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

**SURETY**
Company: *(Corporate Seal)*

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** | | **SURETY** | |
|---|---|---|---|
| Company: | *(Corporate Seal)* | Company: | *(Corporate Seal)* |
| Signature: | | Signature: | |
| Name and Title: | | Name and Title: | |
| Address | | Address | |

**CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.**

FORM OF MAINTENANCE BOND
(TWO YEARS)

KNOW ALL MEN BY THESE PRESENTS:

That We, _____
_____(hereinafter called the Principal)
as Principal and the _____,a_____Corporation with an office
and place of business for the State of New York at _____,New York,
(hereinafter called the Surety) as Surety, are held and firmly bound unto the _____

_____

(hereinafter called the Obligee) as Obligee in the sum of _____
_____($_____)DOLLARS, lawful money
of the United States of America, for the payment whereof the Principal and Surety bind themselves, their successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this _____day of_____,20_____

WHEREAS, the Principal heretofore entered into a written contract

with the Obligee for_____

_____

_____.

WHEREAS, said Contract provides that the Principal shall guarantee

_____

_____

_____

NOW, THEREFORE, the condition of this obligation is such, that if the above Principal shall indemnify the Obligee against loss by reason of his failure to make good at his own expense any defects or deficiencies in materials or workmanship which may appear in the work under said contract with the period of TWO year(s) from the date of acceptance of the work, then this obligation shall be void; otherwise to remain in full force and effect.

_____
Principal

BY:_____

BY:_____

STATE of _____ COUNTY OF _____

On this _____ day of _____ 20___ before me personally appeared the within named _____ to me know, and know to me to be _____ the individual described in and who executed the within bond, and _____ acknowledged to me that he _____ executed the same.

_____

NOTARY PUBLIC

# AIA® Document A132™ – 2009

## *Standard Form of Agreement Between Owner and Contractor,* *Construction Manager as Adviser Edition*

**AGREEMENT** made as of the day of in the year
*(In words, indicate day, month and year.)*

**BETWEEN** the Owner:
*(Name, legal status, address and other information)*

and the Contractor:
*(Name, legal status, address and other information)*

for the following Project:
*(Name, location and detailed description)*

The Construction Manager:
*(Name, legal status, address and other information)*

The Architect:
*(Name, legal status, address and other information)*

The Owner and Contractor agree as follows.

**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.

This document is intended to be used in conjunction with AIA Documents A232™–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2009, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2009, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

AIA Document A232™–2009 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

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## 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 this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully 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 fully execute the Work described in the Contract Documents, except as 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 shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
*(Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)*

Date of Commencement

If, prior to the commencement of the Work, the Owner requires time to file mortgages, mechanics' liens and other security interests, the Owner's time requirement shall be as follows:

**§ 3.2** The Contract Time shall be measured from the date of commencement.

**§ 3.3** The Contractor shall achieve Substantial Completion of the entire Work not later than ( ) days from the date of commencement, or as follows:
*(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)*



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User Notes: (1716538486)

| Portion of the Work | Substantial Completion Date |
|---|---|

, subject to adjustments of this Contract Time as provided in the Contract Documents.
*(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)*

## ARTICLE 4 CONTRACT SUM

**§ 4.1** The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
*(Check the appropriate box.)*

[ ] Stipulated Sum, in accordance with Section 4.2 below

[ ] Cost of the Work plus the Contractor's Fee without a Guaranteed Maximum Price, in accordance with Section 4.3 below

[ ] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

*(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below. Based on the selection above, also complete either Section 5.1.4, 5.1.5 or 5.1.6 below.)*

### § 4.2 Stipulated Sum

**§ 4.2.1** The Stipulated Sum shall be ($ ), subject to additions and deletions as provided in the Contract Documents.

**§ 4.2.2** The Stipulated Sum is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
*(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)*

**§ 4.2.3** Unit prices, if any:
*(Identify and state the unit price, and state the quantity limitations, if any, to which the unit price will be applicable.)*

| Item | Units and Limitations | Price per Unit ($0.00) |
|---|---|---|

**§ 4.2.4** Allowances included in the Stipulated Sum, if any:
*(Identify allowance and state exclusions, if any, from the allowance price.)*

| Item | Allowance |
|---|---|

### § 4.3 Cost of the Work Plus Contractor's Fee without a Guaranteed Maximum Price

**§ 4.3.1** The Contract Sum is the Cost of the Work as defined in Exhibit A, Determination of the Cost of the Work, plus the Contractor's Fee.

**§ 4.3.2** The Contractor's Fee:
*(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)*


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§ **4.3.3** The method of adjustment of the Contractor's Fee for changes in the Work:

§ **4.3.4** Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

§ **4.3.5** Rental rates for Contractor-owned equipment shall not exceed percent ( %) of the standard rate paid at the place of the Project.

§ **4.3.6** Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

| Item | Units and Limitations | Price per Unit ($0.00) |
|---|---|---|

§ **4.3.7** The Contractor shall prepare and submit to the Construction Manager for the Owner, in writing, a Control Estimate within 14 days of executing this Agreement. The Control Estimate shall include the items in Section A.1 of Exhibit A, Determination of the Cost of the Work.

**§ 4.4 Cost of the Work Plus Contractor's Fee with a Guaranteed Maximum Price**
§ **4.4.1** The Contract Sum is the Cost of the Work as defined in Exhibit A, Determination of the Cost of the Work, plus the Contractor's Fee.

§ **4.4.2** The Contractor's Fee:
*(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)*

§ **4.4.3** The method of adjustment of the Contractor's Fee for changes in the Work:

§ **4.4.4** Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

§ **4.4.5** Rental rates for Contractor-owned equipment shall not exceed percent ( %) of the standard rate paid at the place of the Project.

§ **4.4.6** Unit Prices, if any:
*(Identify and state the unit price, and state the quantity limitations, if any, to which the unit price will be applicable.)*

| Item | Units and Limitations | Price per Unit ($0.00) |
|---|---|---|

**§ 4.4.7 Guaranteed Maximum Price**
§ **4.4.7.1** The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed ($ ), subject to additions and deductions by changes in the Work as provided in the Contract Documents. Such maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner. (Insert specific provisions if the Contractor is to participate in any savings.)


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**User Notes:** (1716538486)

§ **4.4.7.2** The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

§ **4.4.7.3** Allowances included in the Guaranteed Maximum Price, if any:
*(Identify and state the amounts of any allowances, and state whether they include labor, materials, or both.)*

| Item | Allowance |
|---|---|

§ **4.4.7.4** Assumptions, if any, on which the Guaranteed Maximum Price is based:

## ARTICLE 5 PAYMENTS

### § 5.1 Progress Payments

§ **5.1.1** Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and upon certification of the Project Application and Project Certificate for Payment or Application for Payment and Certificate for Payment by the Construction Manager and Architect and issuance 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.

§ **5.1.2** The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ **5.1.3** Provided that an Application for Payment is received by the Construction Manager not later than the day of a month, the Owner shall make payment of the certified amount in the Application for Payment to the Contractor not later than the day of the month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment shall be made by the Owner not later than ( ) days after the Construction Manager receives the Application for Payment.
*(Federal, state or local laws may require payment within a certain period of time.)*

### § 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ **5.1.4.1** Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ **5.1.4.2** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ **5.1.4.3** Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**.1** Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of percent ( %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Section 7.3.9 of the General Conditions;

**.2** Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of percent ( %);

**.3** Subtract the aggregate of previous payments made by the Owner; and

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.4 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of the General Conditions.

**§ 5.1.4.4** The progress payment amount determined in accordance with Section 5.1.4.3 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to percent ( %) of the Contract Sum, less such amounts as the Construction Manager recommends and the Architect determines for incomplete Work and unsettled claims; and

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of the General Conditions.

**§ 5.1.4.5** Reduction or limitation of retainage, if any, shall be as follows:
*(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.4.3.1 and 5.1.4.3.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)*

**§ 5.1.5 Progress Payments Where the Contract Sum is Based on the Cost of the Work without a Guaranteed Maximum Price**

**§ 5.1.5.1** With each Application for Payment, the Contractor shall submit the cost control information required in Exhibit A, Determination of the Cost of the Work, along with payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached and any other evidence required by the Owner, Construction Manager or Architect to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed (1) progress payments already received by the Contractor; less (2) that portion of those payments attributable to the Contractor's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

**§ 5.1.5.2** Applications for Payment shall show the Cost of the Work actually incurred by the Contractor through the end of the period covered by the Application for Payment and for which the Contractor has made or intends to make actual payment prior to the next Application for Payment.

**§ 5.1.5.3** Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take the Cost of the Work as described in Exhibit A, Determination of the Cost of the Work;

.2 Add the Contractor's Fee, less retainage of percent ( %). The Contractor's Fee shall be computed upon the Cost of the Work described in that Section at the rate stated in that Section; or if the Contractor's Fee is stated as a fixed sum, an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work bears to a reasonable estimate of the probable Cost of the Work upon its completion;

.3 Subtract retainage of percent ( %) from that portion of the Work that the Contractor self-performs;

.4 Subtract the aggregate of previous payments made by the Owner;

.5 Subtract the shortfall, if any, indicated by the Contractor in the documentation required by Article 5 or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and

.6 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or withdrawn a Certificate for Payment as provided in Section 9.5 of AIA Document A232™–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition.

**§ 5.1.5.4** The Owner, Construction Manager and Contractor shall agree upon (1) a mutually acceptable procedure for review and approval of payments to Subcontractors and (2) the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

**§ 5.1.5.5** In taking action on the Contractor's Applications for Payment, the Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor and shall not be deemed to represent that the Construction Manager and Architect have made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Article 5 or other supporting data; that the Construction Manager and Architect have made exhaustive or continuous on-site inspections; or that the Construction Manager and Architect have made examinations to ascertain how or for what purposes the Contractor has used


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amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

**§ 5.1.5.6** Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

**§ 5.1.6 Progress Payments Where the Contract Sum is Based on the Cost of the Work with a Guaranteed Maximum Price**

**§ 5.1.6.1** With each Application for Payment, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner or Architect to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed (1) progress payments already received by the Contractor; less (2) that portion of those payments attributable to the Contractor's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

**§ 5.1.6.2** Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

**§ 5.1.6.3** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage of completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed; or (2) the percentage obtained by dividing (a) the expense that has actually been incurred by the Contractor on account of that portion of the Work for which the Contractor has made or intends to make actual payment prior to the next Application for Payment by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

**§ 5.1.6.4** Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**.1** Take that portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage of completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values. Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.10 of AIA Document A232–2009;

**.2** Add that portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work, or if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing;

**.3** Add the Contractor's Fee, less retainage of percent ( %). The Contractor's Fee shall be computed upon the Cost of the Work at the rate stated in Section 4.4.2 or, if the Contractor's Fee is stated as a fixed sum in that Section, shall be an amount that bears the same ratio to that fixed-sum fee as the Cost of the Work bears to a reasonable estimate of the probable Cost of the Work upon its completion;

**.4** Subtract retainage of percent ( %) from that portion of the Work that the Contractor self-performs;

**.5** Subtract the aggregate of previous payments made by the Owner;

**.6** Subtract the shortfall, if any, indicated by the Contractor in the documentation required by Section 5.1.6.1 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and

**.7** Subtract amounts, if any, for which the Construction Manager or Architect have withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A232–2009.

**§ 5.1.6.5** The Owner and the Contractor shall agree upon a (1) mutually acceptable procedure for review and approval of payments to Subcontractors and (2) the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

**§ 5.1.6.6** In taking action on the Contractor's Applications for Payment, the Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor and shall not be deemed to represent that the Construction Manager or Architect have made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Section 5.1.6.1 or other supporting data; that the


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Construction Manager or Architect have made exhaustive or continuous on-site inspections; or that the Construction Manager or Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

**§ 5.1.6.7** Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

### § 5.2 Final Payment

**§ 5.2.1** Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

**.1** the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2 of AIA Document A232–2009, and to satisfy other requirements, if any, which extend beyond final payment;

**.2** the Contractor has submitted a final accounting for the Cost of the Work, pursuant to Exhibit A, Determination of the Cost of the Work when payment is on the basis of the Cost of the Work, with or without a Guaranteed Maximum payment; and

**.3** a final Certificate for Payment or Project 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 final Certificate for Payment or Project Certificate for Payment, or as follows:

## ARTICLE 6 DISPUTE RESOLUTION

### § 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A232–2009, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
*(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

### § 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A232–2009, the method of binding dispute resolution shall be as follows:
*(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)*

[ ] Arbitration pursuant to Section 15.4 of AIA Document A232–2009.

[ ] Litigation in a court of competent jurisdiction.

[ ] Other: *(Specify)*

## ARTICLE 7 TERMINATION OR SUSPENSION

### § 7.1 Where the Contract Sum is a Stipulated Sum

**§ 7.1.1** The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2009.

**§ 7.1.2** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2009.


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**§ 7.2 Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price**
**§ 7.2.1** Subject to the provisions of Section 7.2.2 below, the Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2009.

**§ 7.2.2** The Contract may be terminated by the Owner for cause as provided in Article 14 of AIA Document A232–2009; however, the Owner shall then only pay the Contractor an amount calculated as follows:

**.1** Take the Cost of the Work incurred by the Contractor to the date of termination;

**.2** Add the Contractor's Fee computed upon the Cost of the Work to the date of termination at the rate stated in Sections 4.3.2 or 4.4.2, as applicable, or, if the Contractor's Fee is stated as a fixed sum, an amount that bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion; and

**.3** Subtract the aggregate of previous payments made by the Owner.

**§ 7.2.3** If the Owner terminates the Contract for cause when the Contract Sum is based on the Cost of the Work with a Guaranteed Maximum Price, and as provided in Article 14 of AIA Document A232–2009, the amount, if any, to be paid to the Contractor under Section 14.2.4 of AIA Document A232–2009 shall not cause the Guaranteed Maximum Price to be exceeded, nor shall it exceed the amount calculated in Section 7.2.2.

**§ 7.2.4** The Owner shall also pay the Contractor fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Contractor that the Owner elects to retain and that is not otherwise included in the Cost of the Work under Section 7.2.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Contractor shall, as a condition of receiving the payments referred to in this Article 7, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Contractor, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Contractor under such subcontracts or purchase orders.

**§ 7.2.5** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2009; in such case, the Contract Sum and Contract Time shall be increased as provided in Section 14.3.2 of AIA Document A232–2009, except that the term 'profit' shall be understood to mean the Contractor's Fee as described in Sections 4.3.2 and 4.4.2 of this Agreement.

## ARTICLE 8 MISCELLANEOUS PROVISIONS

**§ 8.1** Where reference is made in this Agreement to a provision of AIA Document A232–2009 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

**§ 8.2** Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
*(Insert rate of interest agreed upon, if any.)*

%

**§ 8.3** The Owner's representative:
*(Name, address and other information)*

**§ 8.4** The Contractor's representative:
*(Name, address and other information)*

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**§ 8.5** Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

**§ 8.6** Other provisions:

## ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

**§ 9.1** The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

**§ 9.1.1** The Agreement is this executed AIA Document A132–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition.

**§ 9.1.2** The General Conditions are, AIA Document A232–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition.

**§ 9.1.3** The Supplementary and other Conditions of the Contract:

| Document | Title | Date | Pages |
|---|---|---|---|

**§ 9.1.4** The Specifications:
*(Either list the Specifications here or refer to an exhibit attached to this Agreement.)*

| Section | Title | Date | Pages |
|---|---|---|---|

**§ 9.1.5** The Drawings:
*(Either list the Drawings here or refer to an exhibit attached to this Agreement.)*

| Number | Title | Date |
|---|---|---|

**§ 9.1.6** The Addenda, if any:

| Number | Date | Pages |
|---|---|---|

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

**§ 9.1.7** Additional documents, if any, forming part of the Contract Documents are:


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.1 AIA Document A132™–2009, Exhibit A, Determination of the Cost of the Work, if applicable.

.2 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed, or the following:

.3 AIA Document E202™–2008, Building Information Modeling Protocol Exhibit, if completed, or the following:

.4 Other documents, if any, listed below:
*(List here any additional documents which are intended to form part of the Contract Documents. AIA Document A232–2009 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)*

**ARTICLE 10 INSURANCE AND BONDS**

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A232–2009.
*(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A232–2009.)*

| Type of Insurance or Bond | Limit of Liability or Bond Amount ($0.00) |
|---|---|

This Agreement is entered into as of the day and year first written above.

| | |
|---|---|
| **OWNER** *(Signature)* | **CONTRACTOR** *(Signature)* |
| *(Printed name and title)* | *(Printed name and title)* |


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# AIA® Document A232™ – 2009

## *General Conditions of the Contract for Construction,* *Construction Manager as Adviser Edition*

**for the following PROJECT:**
*(Name, and location or address)*

**THE CONSTRUCTION MANAGER:**
*(Name, legal status and address)*

**THE OWNER:**
*(Name, legal status and address)*

**THE ARCHITECT:**
*(Name, legal status and address)*

**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.

This document is intended to be used in conjunction with AIA Documents A132™–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2009, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2009, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 Basic Definitions

**§ 1.1.1 The Contract Documents.** The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement), and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of addenda relating to bidding requirements).

**§ 1.1.2 The Contract.** The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

**§ 1.1.3 The Work.** The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

**§ 1.1.4 The Project.** The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Multiple Prime Contractors and by the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

**§ 1.1.5 The Drawings.** The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

**§ 1.1.6 The Specifications.** The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

**§ 1.1.7 Instruments of Service.** Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

**§ 1.1.8 Initial Decision Maker.** The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### § 1.2 Correlation and Intent of the Contract Documents

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.


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**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### § 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service

**§ 1.5.1** The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. 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, or Architect's consultants' reserved rights.

**§ 1.5.2** The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

### § 1.6 Transmission of Data in Digital Form

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## ARTICLE 2 OWNER

### § 2.1 General

**§ 2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Article 4, the Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

**§ 2.1.2** The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### § 2.2 Information and Services Required of the Owner

**§ 2.2.1** Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or


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the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.2** Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit.

**§ 2.2.3** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

**§ 2.2.4** The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.2.5** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

**§ 2.2.6** The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents.

### § 2.3 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the 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, except to the extent required by Section 6.1.3.

### § 2.4 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner 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 reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE 3 CONTRACTOR

### § 3.1 General

**§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**§ 3.1.2** The plural term "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

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**§ 3.1.3** The Contractor shall perform the Work in accordance with the Contract Documents.

**§ 3.1.4** The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

**§ 3.2 Review of Contract Documents and Field Conditions by Contractor**

**§ 3.2.1** Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

**§ 3.2.3** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and Architect any nonconformity discovered by or made known to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require.

**§ 3.2.4** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

**§ 3.3 Supervision and Construction Procedures**

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instruction concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner, the Construction Manager, and the Architect and shall not proceed with that portion of the Work without further written instructions from the Architect, through the Construction Manager. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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**§ 3.3.2** The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

**§ 3.3.3** The Contractor shall be responsible for inspection of portions of the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

**§ 3.4 Labor and Materials**

**§ 3.4.1** Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

**§ 3.4.2** Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive.

**§ 3.4.3** The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

**§ 3.5 Warranty**

The Contractor warrants to the Owner, Construction Manager, and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform with the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

**§ 3.6 Taxes**

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

**§ 3.7 Permits, Fees, Notices, and Compliance with Laws**

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay for other permits, fees, licenses and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

**§ 3.7.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

**§ 3.7.3** If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

**§ 3.7.4 Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that 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, the Contractor shall promptly provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect and


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Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that 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, in consultation with the Construction Manager, 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 promptly notify the Owner, Construction Manager, and Contractor in writing, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may proceed as provided in Article 15.

**§ 3.7.5** If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

**§ 3.8 Allowances**

**§ 3.8.1** The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

**§ 3.8.2** Unless otherwise provided in the Contract Documents:

- **.1** Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

**§ 3.8.3** Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

**§ 3.9 Superintendent**

**§ 3.9.1** The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and Architect through the Construction Manager, the name and qualifications of a proposed superintendent. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager, or the Architect has reasonable objection to the proposed superintendent or (2) that any of them require additional time to review. Failure of the Construction Manager to reply within the 14 day period shall constitute notice of no reasonable objection.

**§ 3.9.3** The Contractor shall not employ a proposed superintendent to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

**§ 3.10 Contractor's Construction Schedules**

**§ 3.10.1** The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at

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appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project schedule to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors or the construction or operations of the Owner's own forces.

**§ 3.10.2** The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter update it as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Construction Manager's and Architect's approval. The Architect and Construction Manager's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Construction Manager and Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

**§ 3.10.3** The Contractor shall participate with other Contractors, the Construction Manager and Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

**§ 3.10.4** The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project schedule.

**§ 3.11 Documents and Samples at the Site**

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These documents shall be available to the Architect and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

**§ 3.12 Shop Drawings, Product Data and Samples**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.9 through 4.2.11. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve and submit to the Construction Manager Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the Project submittal schedule approved by the Construction Manager and Architect, or in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Multiple Prime Contractors or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Multiple Prime Contractors.

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**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner, Construction Manager, and Architect, that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed and approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Construction Manager and Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 Use of Site

**§ 3.13.1** The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

**§ 3.13.2** The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

### § 3.14 Cutting and Patching

**§ 3.14.1** The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

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**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner's own forces or of other Multiple Prime Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner's own forces or by other Multiple Prime Contractors except with written consent of the Construction Manager, Owner and such other Multiple Prime Contractors; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the other Multiple Prime Contractors or the Owner the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 Cleaning Up

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager and Architect access to the Work in preparation and progress wherever located.

### § 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, Construction Manager and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner, Architect, or Construction Manager. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect through the Construction Manager.

### § 3.18 Indemnification

**§ 3.18.1** To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the 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 (other than the Work itself) but only to the extent caused by the 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 that would otherwise exist as to a party or person described in this Section 3.18.

**§ 3.18.2** In claims against any person or entity indemnified under this Section 3.18 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 Section 3.18 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' compensation acts, disability benefit acts or other employee benefit acts.

## ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

### § 4.1 General

**§ 4.1.1** The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.


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**§ 4.1.2** The Owner shall retain a construction manager lawfully licensed to practice construction management or an entity lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

**§ 4.1.3** Duties, responsibilities and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Construction Manager, Architect and Contractor. Consent shall not be unreasonably withheld.

**§ 4.1.4** If the employment of the Construction Manager or Architect is terminated, the Owner shall employ a successor construction manager or architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

**§ 4.2 Administration of the Contract**

**§ 4.2.1** The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner and Construction Manager (1) known deviations from the Contract Documents and from the most recent Project schedule prepared by the Construction Manager, and (2) defects and deficiencies observed in the Work.

**§ 4.2.3** The Construction Manager shall provide a staffing plan to include one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner reasonably informed of the progress of the Work, and will report to the Owner and Architect (1) known deviations from the Contract Documents and the most recent Project schedule, and (2) defects and deficiencies observed in the Work.

**§ 4.2.4** The Construction Manager will schedule and coordinate the activities of the Contractor and other Multiple Prime Contractors in accordance with the latest approved Project schedule.

**§ 4.2.5** The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, or charge of, construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

**§ 4.2.6 Communications Facilitating Contract Administration.** Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Construction Manager, and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Multiple Prime Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces shall be through the Owner.

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**§ 4.2.7** The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

**§ 4.2.8** The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. The Construction Manager shall determine in general whether the Work of the Contractor is being performed in accordance with the requirements of the Contract Documents and notify the Owner, Contractor and Architect of defects and deficiencies in the Work. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, upon written authorization of the Owner, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

**§ 4.2.9** The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data and Samples. Where there are Multiple Prime Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from Contractor and other Multiple Prime Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

**§ 4.2.10** The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

**§ 4.2.11** Review of the Contractor's submittals by the Construction Manager and Architect 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, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Construction Manager and Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Construction Manager and Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Construction Manager and Architect, of any 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.

**§ 4.2.12** The Construction Manager will prepare Change Orders and Construction Change Directives.

**§ 4.2.13** The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7. and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

**§ 4.2.14** Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples and similar


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required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

**§ 4.2.15** The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

**§ 4.2.16** If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

**§ 4.2.17** The Architect will interpret and decide matters concerning performance under, and requirements of the Contract Documents on written request of the Construction Manager, Owner or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

**§ 4.2.18** Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

**§ 4.2.19** The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

**§ 4.2.20** The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing to the Construction Manager to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 Definitions

**§ 5.1.1** A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Multiple Prime Contractors or subcontractors of other Multiple Prime Contractors.

**§ 5.1.2** A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

**§ 5.2.1** Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager or the Architect has reasonable objection to any such proposed person or entity or, (2) that the


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Construction Manager, Architect or Owner requires additional time for review. Failure of the Construction Manager, Owner, or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

**§ 5.2.2** The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

**§ 5.2.3** 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 or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

**§ 5.2.4** The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution.

**§ 5.3 Subcontractual Relations**

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to 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 the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

**§ 5.4 Contingent Assignment of Subcontracts**

**§ 5.4.1** Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

**§ 5.4.2** Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

**§ 5.4.3** Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. If the Owner assigns the subcontract to a successor Contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor Contractor's obligations under the subcontract.

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## ARTICLE 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS

### § 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

**§ 6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

**§ 6.1.2** When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager, the Owner shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

**§ 6.1.3** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11 and 12.

### § 6.2 Mutual Responsibility

**§ 6.2.1** The Contractor shall afford the Owner's own forces, Construction Manager and other Multiple Prime Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces or other Multiple Prime Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager and Architect 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 own forces or other Multiple Prime Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a separate contractor or to other Multiple Prime Contractors because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces or other Multiple Prime Contractors.

**§ 6.2.4** The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner, separate contractors, or other Multiple Prime Contractors as provided in Section 10.2.5.

**§ 6.2.5** The Owner and other Multiple Prime Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### § 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, other Multiple Prime Contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Construction Manager, with notice to the Architect, will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 General

**§ 7.1.1** Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

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**§ 7.1.2** A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

**§ 7.2 Change Orders**

A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect and Contractor, stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

**§ 7.3 Construction Change Directives**

**§ 7.3.1** A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.7.

**§ 7.3.4** If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

**§ 7.3.5** Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager and Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

**§ 7.3.6** A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

**§ 7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:


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.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance;
.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
.5 Additional costs of supervision and field office personnel directly attributable to the change.

**§ 7.3.8** The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and Architect. 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, if any, with respect to that change.

**§ 7.3.9** Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

**§ 7.3.10** When the Owner and Contractor agree with a determination made by the Construction Manager and Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

**§ 7.4 Minor Changes in the Work**
The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order issued through the Construction Manager and shall be binding on the Owner and Contractor.

## ARTICLE 8 TIME

**§ 8.1 Definitions**
**§ 8.1.1** Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

**§ 8.1.2** The date of commencement of the Work is the date established in the Agreement.

**§ 8.1.3** The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

**§ 8.1.4** The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

**§ 8.2 Progress and Completion**
**§ 8.2.1** Time limits stated in the Contract Documents 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.

**§ 8.2.2** 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 effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

**§ 8.2.3** The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

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**§ 8.3 Delays and Extensions of Time**

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner, Owner's own forces, Construction Manager, Architect, any of the other Multiple Prime Contractors or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration, or by other causes that the Architect, based on the recommendation of the Construction Manager, determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

**§ 8.3.2** Claims relating to time shall be made in accordance with applicable provisions of Article 15.

**§ 8.3.3** This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

**ARTICLE 9 PAYMENTS AND COMPLETION**

**§ 9.1 Contract Sum**

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

**§ 9.2 Schedule of Values**

Where the Contract is based on a Stipulated Sum or Guaranteed Maximum Price, the Contractor shall submit to the Construction Manager, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. In the event there is one Contractor, the Construction Manager shall forward to the Architect the Contractor's schedule of values. If there are Multiple Prime Contractors responsible for performing different portions of the Project, the Construction Manager shall forward the Multiple Prime Contractors' schedules of values only if requested by the Architect.

**§ 9.3 Applications for Payment**

**§ 9.3.1** At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner, Construction Manager or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

**§ 9.3.1.1** As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Construction Manager and Architect, but not yet included in Change Orders.

**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier unless such Work has been performed by others whom the Contractor intends to pay.

**§ 9.3.2** Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

**§ 9.3.3** The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for


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Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

**§ 9.4 Certificates for Payment**

**§ 9.4.1** Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either issue to the Owner a Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

**§ 9.4.2** Where there are Multiple Prime Contractors performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives the Multiple Prime Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Multiple Prime Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Multiple Prime Contractors' application with information from similar applications for progress payments from other Multiple Prime Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Multiple Prime Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

**§ 9.4.3** Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

**§ 9.4.4** The Construction Manager's certification of an Application for Payment or, in the case of Multiple Prime Contractors, a Project Application and Certificate for Payment shall be based upon the Construction Manager's evaluation of the Work and the information provided as part of the Application for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information and belief, the Work has progressed to the point indicated and the quality of the Work is in accordance with the Contract Documents. The certification will also constitute a recommendation to the Architect and Owner that the Contractor be paid the amount certified.

**§ 9.4.5** The Architect's issuance of a Certificate for Payment or in the case of Multiple Prime Contractors, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and information provided as part of the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified.

**§ 9.4.6** The representations made pursuant to Sections 9.4.4 and 9.4.5 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Construction Manager or Architect.

**§ 9.4.7** The issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques,


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sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

**§ 9.5 Decisions to Withhold Certification**

**§ 9.5.1** The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.4 and 9.4.5 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.3. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a separate contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

**§ 9.5.2** When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

**§ 9.5.3** If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager and both will reflect such payment on the next Certificate for Payment.

**§ 9.6 Progress Payments**

**§ 9.6.1** After the Architect has issued a Certificate for Payment or Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Construction Manager and Architect.

**§ 9.6.2** The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

**§ 9.6.3** The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

**§ 9.6.4** The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner, Construction Manager nor

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Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

**§ 9.6.5** Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

**§ 9.6.6** A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

**§ 9.6.7** Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

**§ 9.7 Failure of Payment**

If the Construction Manager and Architect do not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, within fourteen days after the Construction Manager's receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Construction Manager and Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

**§ 9.8 Substantial Completion**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager, and the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the list, which is not sufficiently complete in accordance with the requirements of the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion.

**§ 9.8.4** When the Architect, assisted by the Construction Manager, determines that the Work or designated portion thereof is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.


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**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

**§ 9.9 Partial Occupancy or Use**

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Construction Manager, 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 Work.

**§ 9.9.3** Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

**§ 9.10 Final Completion and Final Payment**

**§ 9.10.1** Upon completion of the Work, the Contractor shall forward to the Construction Manager a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager will evaluate the completion of Work of the Contractor and then forward the notice and Application, with the Construction Manager's recommendations, to the Architect who will promptly make such inspection. When the Architect, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.


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**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

**§ 9.10.4** The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

**§ 9.10.5** Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors.
The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

### § 10.2 Safety of Persons and Property

**§ 10.2.1** The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and
- **.4** construction or operations by the Owner or other Contractors.

**§ 10.2.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

**§ 10.2.3** The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

**§ 10.2.4** When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

**§ 10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly

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employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

**§ 10.2.6** The Contractor shall designate a responsible member of the Contractor's 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 Owner, Construction Manager and Architect.

**§ 10.2.7** The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 Injury or Damage to Person or Property**
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 Hazardous Materials**
**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to, asbestos or polychlorinated biphenyl (PCB),encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing.

**§ 10.3.2** Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resumed upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, 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 (other than the Work itself), except to the extent that such damage, loss or expense is not due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

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**§ 10.3.5** The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

**§ 10.4 Emergencies**

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. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

## ARTICLE 11 INSURANCE AND BONDS *ALSO SEE SUPPLEMANTARY GENERAL CONDITIONS

**§ 11.1 Contractor's Liability Insurance**

**§ 11.1.1** The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by 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** Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

**§ 11.1.2** The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, 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 and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

**§ 11.1.3** Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness.

**§ 11.1.4** The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Construction Manager, the Construction Manager's consultants, the Owner, the Architect, and the Architect's

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consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

**§ 11.2 Owner's Liability Insurance**
The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

**§ 11.3 Property Insurance**
**§ 11.3.1** Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

**§ 11.3.1.1** Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss.

**§ 11.3.1.2** If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

**§ 11.3.1.3** If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

**§ 11.3.1.4** This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

**§ 11.3.1.5** Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

**§ 11.3.2 Boiler and Machinery Insurance.** The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

**§ 11.3.3 Loss of Use Insurance.** The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.


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**§ 11.3.4** If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

**§ 11.3.5** If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

**§ 11.3.6** Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

**§ 11.3.7 Waivers of Subrogation.** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees each of the other, and (2) the Construction Manager, Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, Owner's separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

**§ 11.3.8** A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

**§ 11.3.9** If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

**§ 11.3.10** The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or distribution of insurance proceeds in accordance with the direction of the arbitrators.


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**§ 11.4 Performance Bond and Payment Bond**

**§ 11.4.1** The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

**§ 11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

**§ 12.1 Uncovering of Work**

**§ 12.1.1** If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their observation and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

**§ 12.2 Correction of Work**

**§ 12.2.1 Before or After Substantial Completion**

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

**§ 12.2.2 After Substantial Completion**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, 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. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

**§ 12.2.2.2** The one-year period shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors or other Multiple Prime Contractors caused by the

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Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### § 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### § 13.2 Successors and Assigns

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**§ 13.2.2** The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

### § 13.3 Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity or to an officer of the corporation for which it was intended; or if delivered at or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### § 13.4 Rights and Remedies

**§ 13.4.1** Duties and obligations imposed by the Contract Documents 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.

**§ 13.4.2** No action or failure to act by the Owner, Construction Manager, 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.

### § 13.5 Tests and Inspections

**§ 13.5.1** Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall 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, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and


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(2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

**§ 13.5.2** If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs except as provided in Section 13.5.3, shall be at the Owner's expense.

**§ 13.5.3** If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses shall be at the Contractor's expense.

**§ 13.5.4** Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

**§ 13.5.5** If the Construction Manager or Architect is to observe tests, inspections or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

**§ 13.5.6** Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

### § 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

### § 13.7 Time Limits on Claims

The Owner and the Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and the Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 Termination by the Contractor

**§ 14.1.1** The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- **.3** Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.


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**§ 14.1.2** The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

**§ 14.1.3** If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

**§ 14.1.4** If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

**§ 14.2 Termination by the Owner for Cause**

**§ 14.2.1** The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

**§ 14.2.2** When any of the above reasons exist, the Owner, after consultation with the Construction Manager, and upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

**§ 14.2.3** When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

**§ 14.2.4** If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

**§ 14.3 Suspension by the Owner for Convenience**

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

**§ 14.3.2** The Contract Sum and the Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:


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.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of this Contract.

**§ 14.4 Termination by the Owner for Convenience**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

## ARTICLE 15 CLAIMS AND DISPUTES

**§ 15.1 Claims**

**§ 15.1.1 Definition.** A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, 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 The responsibility to substantiate Claims shall rest with the party making the Claim.

**§ 15.1.2 Notice of Claims.** Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect, if the Construction Manager and or Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

**§ 15.1.3 Continuing Contract Performance.** Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Construction Manager will prepare Change Orders and the Architect will issue a Certificate for Payment or Project Certificate for Payment in accordance with the decisions of the Initial Decision Maker.

**§ 15.1.4 Claims for Additional Cost.** If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3.

**§ 15.1.5 Claims for Additional Time**

**§ 15.1.5.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

**§ 15.1.5.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

**§ 15.1.6 Claims for Consequential Damages.** The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

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.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

**§ 15.2 Initial Decision**

**§ 15.2.1** Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

**§ 15.2.2** The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

**§ 15.2.3** In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

**§ 15.2.4** If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

**§ 15.2.5** The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect and Construction Manager, if the Architect or Construction Manager is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

**§ 15.2.6** Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

**§ 15.2.6.1** Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

**§ 15.2.7** In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

**§ 15.2.8** If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.


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**§ 15.3 Mediation**

**§ 15.3.1** Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

**§ 15.3.2** The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

**§ 15.3.3** The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

**§ 15.4 Arbitration**

**§ 15.4.1** If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

**§ 15.4.1.1** A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

**§ 15.4.2** The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

**§ 15.4.3** The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

**§ 15.4.4 Consolidation or Joinder**

**§ 15.4.4.1** Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

**§ 15.4.4.2** Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.


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# SECTION 00 07 20

# SUPPLEMENTARY GENERAL CONDITIONS

The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction" A.I.A. Document A232-2009 edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph, or Clause thereof is modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

## ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

*Delete Subparagraph 1.1.1 and replace with the following:*

1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Instructions to Bidders, the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other conditions), Drawings, Specifications; Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

*Add the following sentence to Subparagraph 1.2.2:*

The items listed under the SUMMARY ARTICLE in each section of the specifications are in intended as a guide without limiting the scope of the work.

*Add the following new Subparagraphs 1.2.4 and 1.2.5:*

1.2.4 Sections of Division 1 – General Requirements govern the execution of the work of all sections of the specifications.

1.2.5 If in the interpretation of Contract documents it appears that the Drawings and/or Specifications are not in agreement in whole or in part, the one requiring the **GREATER QUANTITY OR SUPERIOR QUALITY SHALL PREVAIL**, as decided by the Architect.

## ARTICLE 2 - OWNER

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

*Delete Subparagraph 2.2.5 and substitute the following:*

2.2.5 The Contractor will be furnished free of charge A link to the FTP site for free downloading PDF files of the contract documents Drawings and Project Manuals. For additional sets of hard copy sets of the plans and/or specifications please contact the printer for this project. As listed in “Notice to Bidders Section 00 01 13”

**ARTICLE 3 – CONTRACTOR**

3.5 WARRANTY

*Add the following new Subparagraphs3.5.1 & 3.5.2:*
3.5.1 The warranty provided in paragraph 3.5 shall be in addition to and not in limitation of any other warranty or remedy required by law or by the Contract Documents.
3.5.2 The contractor shall deliver to the owner upon completion of all work under this contract, its written guarantee made out to the owner in a form satisfactory to the Owner, guaranteeing (and it does hereby so guarantee), all of the work under the Contract to be free from faulty labor or faulty materials. This guarantee shall be made to cover (and does cover) a period of one year from the date of completion of all work under the Contract or for a longer period where so stipulated in the Contract Documents. The warranty set forth herein shall survive expiration and /or termination of this contract.

3.6 TAXES

*Delete paragraph 3.6.1 and insert the following:*
3.6.1 The Owner is exempt from payment of Federal, State and local sales and use taxes, on all materials and supplies incorporated into the project pursuant to the provisions of this Contract. This exemption does not, however, apply to tools, machinery, equipment, or other property leased by or to a contractor or a subcontractor and the contractor and his subcontractors shall be responsable for any and all applicable taxes, including sales and compensating use taxes, on such leased tools, machinery, equipment or other property.

3.10 CONTRACTOR'S PROGRESS SCHEDULE

*Add the following new Subparagraphs 3.10.5 3.10.6, 3.10.7, 3.10.8 and 3.10.9:*
3.10.5 The Contractor shall establish schedules for (a) the progress of the work as a whole and for the various parts, and (b) a materials delivery schedule.
3.10.6 The Contractor shall notify the Owner, Architect and Construction Manager immediately in writing of any occurrences that could forcibly cause a deviation from schedules.
3.10.7 No adjustment or extension of the schedule or time in which the Contract is to be performed will be made or granted except as provided in Paragraph 8.3 It shall be the responsibility of the Contractor to distribute copies of the Progress Schedule to all interested parties, and to prepare and distribute any revisions of said schedules at his cost and expense.
3.10.8 The Contractor and each subcontractor shall so prosecute their work that they not only maintains their progress in accordance with the schedule, but also shall cause no delays to other contractors and subcontractors engaged on the project.
3.10.9 Should the Contractor, either in person or through a subcontractor, fail to maintain progress according to the Progress Schedule, or cause delay to another contractor or subcontractor, they shall furnish such additional labor and/or services or work such overtime as may be necessary to bring their operations up to schedule, at their own expense. Failure to maintain schedule or to take the above steps to regain the schedule shall constitute default.

## ARTICLE 7 - CHANGES IN THE WORK

### 7.3 CONSTRUCTION CHANGE DIRECTIVES

*Add the following new Subparagraph 7.3.11:*

7.3.11 In Subparagraph 7.3.7, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

.1 For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.

.2 For the Contractor, for Work performed by the Contractor's Subcontractor, 10 percent of the amount due the Subcontractor.

.3 Cost to which overhead and profit are to be applied shall be determined in accordance with Subparagraph 7.3.7.

.4 All proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and Sub-contracts with the latter submitted in typewritten form on the Sub-Contractor's company letterhead.

*Add the following new Subparagraph 7.3.12:*

7.3.12 Delays and approvals for extension of time to the Contract completion date shall not be considered as Changes in the Work and as such shall not entitle the Contractor to claims for additional compensation.

## ARTICLE 8 – TIME

*Add the following new Subparagraph 8.2.4:*

8.2.4 The date of commencement is the date from which the Contract Time of Paragraph 8.1.2 is measured, and shall be the date of the Agreement, as first written, unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

The date of commencement shall be determined in the notice to proceed. Unless the date of commencement is established by a notice to proceed issued by the Owner, the Contractor shall notify the Owner, through the Construction Manager, in writing not less than five days before commencing the Work to permit the timely filing of mortgages, mechanic's liens, and other security interests.

### 8.3 DELAYS AND EXTENSIONS OF TIME

*Delete Subparagraph 8.3.1 and insert the following:*

8.3.1 If the Contractor is delayed at any time in the progress of the work by any cause beyond his control and which, in the opinion of the Architect, based on the recommendation of the Construction Manager, should entitle the Contractor to an extension of time, such as unavoidable casualties, substantial changes ordered in the work, or other similar occurrences, the time to perform or the date of completion shall be extended for such period as the Architect shall determine. Adverse weather conditions, however, shall not constitute a ground for an extension of time unless in the opinion of the Architect they are catastrophic in nature.

*Add the following new Subparagraph 8.3.4 and 8.3.5:*

8.3.4 Granting of an extension of time shall not be considered a change in the Work nor will it be considered grounds for additional compensation from the Owner.

8.3.5 Notwithstanding anything to the contrary in the Contract Documents, an extension of the Contract Time, to the extent permitted under Paragraph 8.3.1 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 (4) any delay-related claim (collectively referred in this subparagraph 8.3.3 as "Delay") whether or not such Delay is foreseeable. In no event shall the Contractor be entitled to any compensation or recovery of any damages, in connection with any Delay, including, without limitation, consequential damages, lost opportunity cost, impact damages, labor inefficiency damages, or overhead costs.

**ARTICLE 9 - PAYMENTS AND COMPLETION**

9.3 APPLICATIONS FOR PAYMENT

*Delete Subparagraph 9.3.1 and insert the following:*

9.3.1 The Owner will make partial payments to the Contractor monthly on the basis of a duly certified estimate of the work performed during the preceding calendar month as prepared by the Contractor and determined by the Construction Manager and Architect to be properly due. At least ten days before the date established for each progress payment, the Contractor shall submit to the Construction Manager and Architect an itemized Application for Payment, notarized, subscribed and acknowledged in conformity with the laws of the State of New York, supported by such data substantiating the Contractor's right to payment as the Owner, Construction Manager or the Architect may require, such as copies of requisitions from subcontractors and material suppliers. In making such partial payment monthly, there shall be retained Five (5) percent of the payment amount due. The form of Application for Payment shall be a notarized AIA Doc G-702/Cma, Application and Certification for Payment, supported by AIA G-703, Continuation Sheet.

**ARTICLE 11 - INSURANCE AND BONDS (ALSO SEE EXHIBIT "A" AT THE END OF SECTION FOR FUTHER INORMATION)**

*Add the following Clause 11.1.1.9 to 11.1.1:*

11.1.1.9 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:

.1 Premises - Operation (including X, C and U coverages as applicable).
.2 Independent Contractor's Protective.
.3 Products and Completed Operations.
.4 Personal Injury Liability with Employment Exclusion deleted.
.5 Contractual, including specified provision for Contractor's obligations under Paragraph 3.18.
.6 Owned, non-owned, and hired motor vehicles.
.7 Broad Form Property Damage, including Completed Operations.
.9 Pollution Liability

*Add the following Clause 11.1.2.1 to 11.1.2:*
The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:

Workers' Compensation:

| | | |
|---|---|---|
| (a) | State: | Statutory |
| (b) | Applicable Federal (e.g., Longshoremen's): | Statutory |
| (c) | Employer's Liability: | $1,000,000 per Accident |
| | | $1,000,000 Disease, Policy Limit |
| | | $1,000,000 Disease, Each Employee |

Comprehensive or Commercial General Liability-per project (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

| | | | |
|---|---|---|---|
| (a) | Bodily Injury: | $1,000,000 | Each Occurrence |
| | | $2,000,000 | Aggregate |
| (b) | Property Damage: | $1,000,000 | Each Occurrence |
| | | $2,000,000 | Aggregate |

Products and Completed Operations to be maintained for 5 years after final payment:
$2,000,000 Aggregate
Property Damage Liability Insurance shall provide X, C and U coverage. Yes.

Broad Form Property Damage Coverage shall include Completed Operations. Yes.

Contractual Liability:

| | | | |
|---|---|---|---|
| (a) | Bodily Injury: | $1,000,000 | Each Occurrence |
| | | $2,000,000 | Aggregate |
| (b) | Property Damage: | $1,000,000 | Each Occurrence |
| | | $2,000,000 | Aggregate |

Personal Injury, with Employment Exclusion deleted:
$2,000,000 Aggregate

Business Auto Liability (including owned, non-owned and hired vehicles):

| | | | |
|---|---|---|---|
| (a) | Bodily Injury: | $1,000,000 | Each Person |
| | | $2,000,000 | Each Occurrence |
| (b) | Property Damage: | $1,000,000 | Each Occurrence |

If the General Liability coverages are provided by a Commercial Liability policy, the:
General Aggregate shall be not less than $2,000,000 and it shall apply, in total, to this Project only.
Fire Damage Limit shall be not less than $300,000 on any one Fire.
Medical Expense Limit shall be not less than $10,000 on any one person.

Umbrella Excess Liability: $5,000,000 over primary insurance
$10,000 retention for self-insured hazards each occurrence

Contractors Pollution Liability coverage of at least $1,000,000 per occurrence arising out of bodily injury, property damage, clean-up costs, environmental damage caused by a pollution incident from your work, completed operations, transportation.

*Add the following sentence to Subparagraph 11.1.3*:
If this insurance is written on the Comprehensive General Liability policy form, the Certificates shall be AIA Document G705, Certificate of Insurance. If this insurance is written on a Commercial General Liability policy form, ACORD forms 25S will be acceptable.

*Add the following Clause 11.3.7.1 to 11.3.7*:
Waiver of Subrogation applies in favor of the Village of Ardsley as respects to all policies required by contract including workers compensation, pursuant to and subject to the policy's terms, definitions, conditions and exclusions.

**All insurance policies must be held with carriers rated with AM Best A- VII or better and be licensed to do business in the state of NY**

11.4 PERFORMANCE BOND AND PAYMENT BOND

*Delete Subparagraph 11.4.1 as written and insert the following:*
11.4.1 The Contractor shall, at his cost and expense, furnish bonds in the amount of 100 percent of the Contract Sum covering the faithful performance of the contract and the payment of all obligations arising thereunder, in such form as the Owner may prescribe and with such sureties may be approved by the Owner. Said bonds shall remain in full force and effect during the term of any warranty or guarantee to be furnished hereunder, and in no event for a period of less than one year following the issuance of a final certificate. The Contractor shall keep the bonding company informed of any and all changes in the amount of his contract with the Owner.

**ARTICLE 13 – MISCELLANEOUS PROVISIONS**

13.5 TESTS AND INSPECTIONS

*Add the phrase* "or public utility company" *after the words* "public authority(ies)" *in the third and eighth lines of Subparagraph 13.5.1.*
*Add the phrase* "or public utility company" *after the words* "public authorities*" in the second line of Subparagraph 13.5.2.*

13.6 INTEREST
*Delete Paragraph 13.6*

13.7 Delete Section 13.7 in its entirety and replace it with the following:

13.7 Time Limits on Claims. Claims by Contractor must be made within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is earlier. Claims by Owner must be made within a reasonable time after Owner recognizes the conditions giving rise to the Claim. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

13.10 LABOR REQUIREMENTS

13.10.1 The Contractor and each Subcontractor performing the Work under this Contract shall comply with all applicable labor laws.
13.10.2 State of New York, Department of Labor, Bureau of Public Work, Contract Requirements and Schedules of Prevailing Hourly Wage Rates and Supplements are contract requirements.
13.10.3 Contractor shall submit to the Owner monthly transcripts of Certified payroll records in a form accepted by the New York State Department of Labor.
13.10.4 Updated wage rates are available on-line from the New York State Department of Labor's web site.

**ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT**

Section 14.2.2 – delete the words "after consultation with the Construction Manager, and upon certification by the Architect".

**EXHIBIT A- Insurance Requirements Section**

A. Commercial General Liability (per project) issued on an Occurrence form with a combined single limit for Bodily Injury, Personal Injury and Property Damage of at least $1,000,000 per occurrence and $2,000,000 in the aggregate. Aggregate limit shall apply per project. Coverage shall include endorsements for: Products/Completed Operations; Advertising Injury, Personal Injury, Contractual Liability for tort liability assumed under contract, Mobile Equipment not subject to statutory vehicle insurance requirements, Waiver of Subrogation. Additional insured is required for the designated additional insured listed in Section II and shall be provided on a primary non-contributory basis for the additional insured. There shall be no coverage restrictions and/or coverage exclusions involving NY Labor Law statutes, gravity related injury, Third Party Over type actions.

B. Statutory Workers Compensation in accordance with statutory provisions and $1,000,000 Employer's Liability. Coverage shall extend to work performed in all states the contractor is providing on site workplace services to. Coverage shall include waiver of subrogation.

C. Commercial Automobile Liability coverage with a combined Bodily Injury and Property Damage limit of at least $1,000,000 per occurrence, including coverage for any auto, non-owned autos, and hired autos. Coverage shall include waiver of subrogation.

D. Umbrella Liability/Excess Liability coverage of at least $5,000,000 per occurrence. Umbrella policy is to be provided on at least a follow form basis of the all the underlying General Liability, Automobile Liability, and Workers' Compensation coverage.

E. Contractors Pollution Liability coverage of at least $1,000,000 per occurrence arising out of bodily injury, property damage, clean-up costs, environmental damage caused by a pollution incident from your work, completed operations, transportation.

II. The insurance coverage shall include the following entities as scheduled additional insureds, for General Liability, Contractors Pollution, and Umbrella Liability/Excess Liability and coverage shall be primary and non-contributory to any insurance that may be in effect for the additional insured's. The additional insured endorsement must be provided using an Insurance Services (ISO) form CG 20 10 07 04 and CG 20 37 07 04 or an exact equivalent. The scheduled Additional Insured as follows:

Project location: Certificate holder Mailing Address:

III. The certificate of insurance is to specifically state that the carrier will notify Certificate Holder of any cancellation, non-renewal or material modification of existing policy. Notice is to be received 30 days prior to any change in status in writing by certified mail. The certificate shall list all relevant coverage terms and conditions, including disclosure of any and all coverage restrictions, coverage warranties, and coverage exclusions applicable to the project. The certificate holder upon written request shall obtain a certified copy of the Contractors, Vendors. Service Providers, Independent Contractors insurance policy for review.

IV. If the Contractor or Vendor utilizes the services of another contractor, vendor, and/or independent contractor the same provisions of this Insurance Requirements Agreement shall apply.

V. Vendor, Service Provider, Independent Contractor is responsible for insuring own personal, business, equipment, property.

VI. Additional Requirements:

The Certificate Holder should be listed as:

Village of Ardsley
570 Ashford Avenue,
Ardsley, NY 10502

Please list the Project Name and the following as "Additional Insured":

- The Village of Ardsley its Mayor, Trustees, Manager, officers, employees, volunteers and Village's consultants shall be included as additional insured with respects to General, Auto, Pollution and Umbrella Liability where required by written contract. General, Auto, Pollution and Umbrella Liability is primary and non-contributory as required per written contract. A Waiver of Subrogation and 30 Day Notice of Cancellation is provided in accordance with the policy terms and conditions.

- Weston and Sampson and their consultants, 1 Winners Circle, Suite 130, Albany, NY 12205

- Calgi Construction Company, Inc. and their consultants 56 Lafayette Avenue Ste. 350, White Plains, NY 10603

- Asbestos Abatement Monitoring Services and Special Inspection Agency are to be named later, and their respective members, officers, employees and agents

END OF SECTION 00 07 20

SECTION 00 08 01

PREVAILING WAGE SCHEDULE

1. GENERAL:

A. The following are instructions for obtaining the minimum prevailing wage rates, health and welfare and pension fund contributions as determined by the Industrial Commissioner of the State of New York in accordance with the provisions of Section 220 of the Labor Law.

B. All contractors will be bound and obligated by the Laws of New York State to insure payment to all workers involved with the construction of the project.

2. MINIMUM WAGE RATES:

A. The current wage and benefit rates are available when following the instruction on the attached page.

# WAGE RATE ATTACHMENTS

The "Request for Wage and Supplement Information" (PW 39) you have submitted has been accepted, and a Prevailing Rate Case Number (PRC# 2022003355 - New Public Works Facility) has been assigned to the project.

To access the PDF file of your schedule, click on
https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1529785 or copy and paste into your browser

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Village of Ardsley

Tracey Arena, Dir Business
56 Lafayette Ave
Ste 350
White Plains NY 10603

| | |
|---|---|
| Schedule Year | 2021 through 2022 |
| Date Requested | 03/28/2022 |
| PRC# | 2022003355 |

| | |
|---|---|
| Location | Village of Ardsley |
| Project ID# | VOA1811 |
| Project Type | New DPW Facility |

## 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 2021 through June 2022. 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. 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

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# CONSTRUCTION MILESTONE SCHEDULE

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Divisions 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes Milestone dates to be met and indicated in the Contractor's Construction Schedule.

B. Related Sections include the following:

1. Division 1 Section "Summary of Multiple of Primes" for preparing combined Contractor's combined Construction Schedule.
2. Division 1 Section "Submittal Procedures" for submitting schedules and reports and for submittal schedule.
3. Division 1 Section "Progress Schedule" for preparing and submitting Contractor's Construction Schedule

### 1.3 MILESTONE

A. The following preliminary construction schedule indicates milestones that are critical points in time, which must be incorporated in the Contractor's Construction Schedule.

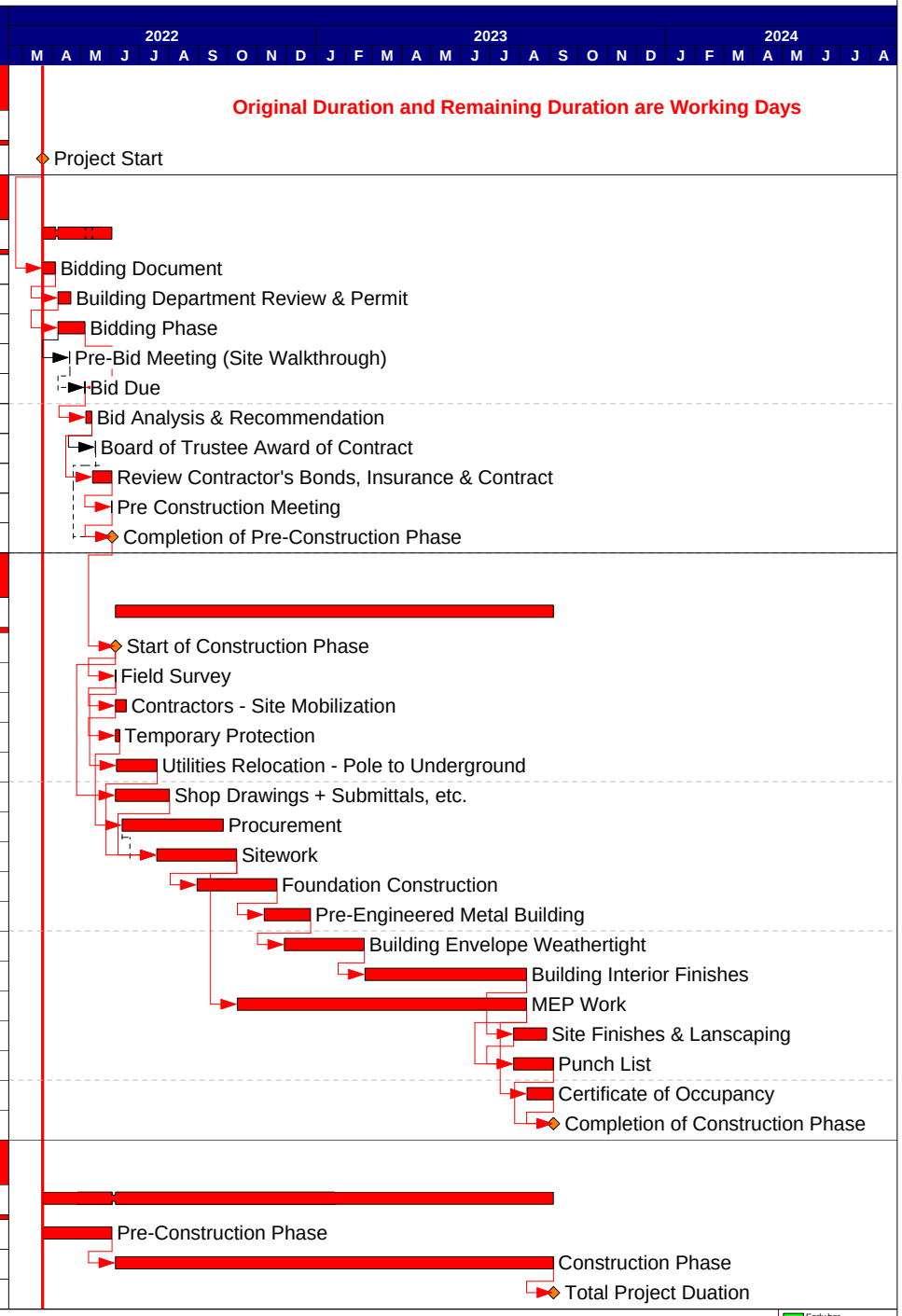
1. April 7, 2022-Release of Specifications and Drawings
2. April 19, 2022 - Pre-Bid Meeting
3. May 5, 2022- Bid Due Date
4. May 16, 2022- Contract Award
5. June 6, 2022 - Construction Start
6. September 5, 2023 – Construction Completion

## PART 2 – PRODUCTS (Not Used)

## PART 3 – EXECUTIONS (Not Used)

END OF SECTION

| Act ID | RESP | Description | Orig Dur | Rem Dur | Early Start | Early Finish |
|---|---|---|---|---|---|---|
| **Start** | | | | | | |
| | | | 0 | 0 | 22MAR22 | 22MAR22 |
| 1000 | | Project Start | 0 | 0 | 22MAR22 | |
| **Pre-Construction Phases** | | | | | | |
| | | | 53d | 53d | 22MAR22 | 02JUN22 |
| 1120 | **W&S** | Bidding Document | 10d | 10d | 22MAR22 | 04APR22 |
| 1130 | **VOA** | Building Department Review & Permit | 10d | 10d | 07APR22 | 20APR22 |
| 1140 | **TEAM** | Bidding Phase | 21d | 21d | 07APR22 | 05MAY22 |
| 1150 | **TEAM** | Pre-Bid Meeting (Site Walkthrough) | 1d | 1d | 19APR22 | 19APR22 |
| 1160 | **TEAM** | Bid Due | 1d | 1d | 05MAY22 | 05MAY22 |
| 1170 | **TEAM** | Bid Analysis & Recommendation | 5d | 5d | 06MAY22 | 12MAY22 |
| 1172 | **VOA** | Board of Trustee Award of Contract | 1d | 1d | 16MAY22 | 16MAY22 |
| 1180 | **TEAM** | Review Contractor's Bonds, Insurance & Contract | 15d | 15d | 13MAY22 | 02JUN22 |
| 1190 | **TEAM** | Pre Construction Meeting | 1d | 1d | 02JUN22 | 02JUN22 |
| 1200 | | Completion of Pre-Construction Phase | 0 | 0 | | 02JUN22 |
| **Construction Phase** | | | | | | |
| | | | 325d | 325d | 06JUN22 | 05SEP23 |
| 1210 | | Start of Construction Phase | 0 | 0 | 06JUN22 | |
| 1220 | **PRIMES** | Field Survey | 1d | 1d | 06JUN22 | 06JUN22 |
| 1230 | **PRIMES** | Contractors - Site Mobilization | 10d | 10d | 06JUN22 | 17JUN22 |
| 1240 | **PRIMES** | Temporary Protection | 5d | 5d | 06JUN22 | 10JUN22 |
| 1245 | **PRIMES** | Utilities Relocation - Pole to Underground | 30d | 30d | 07JUN22 | 19JUL22 |
| 1250 | **PRIMES** | Shop Drawings + Submittals, etc. | 40d | 40d | 06JUN22 | 01AUG22 |
| 1260 | **PRIMES** | Procurement | 75d | 75d | 13JUN22 | 26SEP22 |
| 1270 | **PRIMES** | Sitework | 60d | 60d | 19JUL22 | 10OCT22 |
| 1280 | **PRIMES** | Foundation Construction | 60d | 60d | 30AUG22 | 21NOV22 |
| 1290 | **PRIMES** | Pre-Engineered Metal Building | 35d | 35d | 08NOV22 | 26DEC22 |
| 1300 | **PRIMES** | Building Envelope Weathertight | 60d | 60d | 29NOV22 | 20FEB23 |
| 1310 | **PRIMES** | Building Interior Finishes | 120d | 120d | 21FEB23 | 08AUG23 |
| 1320 | **PRIMES** | MEP Work | 215d | 215d | 11OCT22 | 08AUG23 |
| 1330 | **PRIMES** | Site Finishes & Lanscaping | 25d | 25d | 26JUL23 | 29AUG23 |
| 1340 | **PRIMES** | Punch List | 30d | 30d | 26JUL23 | 05SEP23 |
| 1350 | **PRIMES** | Certificate of Occupancy | 20d | 20d | 09AUG23 | 05SEP23 |
| 1360 | | Completion of Construction Phase | 0 | 0 | | 05SEP23 |
| **Summary** | | | | | | |
| | | | 379d | 379d | 22MAR22 | 05SEP23 |
| 1370 | | Pre-Construction Phase | 53d | 53d | 22MAR22 | 02JUN22 |
| 1380 | | Construction Phase | 325d | 325d | 06JUN22 | 05SEP23 |
| 1390 | | Total Project Duation | 0 | 0 | | 05SEP23 |




| | |
|---|---|
| Start date | 22MAR22 |
| Finish date | 05SEP23 |
| Data date | 22MAR22 |
| Run date | 06APR22 |
| Page number | 1A |

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Early bar
Progress bar
Critical bar
Summary bar
Start milestone point
Finish milestone point

# SECTION 00 31 32
# SUBSURFACE DATA

## PART I - GENERAL

1.01 SCOPE:

A. A subsurface exploration program consisting of soil borings and excavations has been performed, with reasonable care. A site plan, boring and test pit logs, and geotechnical laboratory test data for selected soil samples are appended hereto and are a part of the Contract Documents.

The following geotechnical reports and studies have been completed for the project. Copies of these reports are attached as Appendices A and B. Electronic copies may also be provided upon request during the bidding period only.

- Appendix A - "Geotechnical Engineering Report, Proposed DPW Facility, 220 Heatherdell Rd., Ardsley New York" dated October 2, 2020;

- Appendix B - "Vacuum Excavation Data Sheets" (7 pages) dated March 16, 2021.

If Contractors deem the subsurface information insufficient, they may, after obtaining Owner's permission, carry out additional subsurface explorations, at no expense to the Owner.

B. Subsurface information provided in the Contract Documents is limited by the methods used for obtaining and expressing such data, and is subject to various interpretations. The terms used to describe soils, rock, groundwater and such other conditions are subject to local usage and individual interpretation.

C. Borings have been advanced and test pits excavated substantially at the locations indicated on the drawings and to the depths shown on the logs. Soil information presented in the logs, as to classification, gradation, properties, density and consistency, is based on visual observation of recovered samples. Groundwater levels reported on the logs are those measured in the field at the particular location and at the time measurements were made, and do not necessarily represent permanent groundwater elevations. Groundwater elevations may be affected by temperature, rainfall, tidal fluctuation, and other factors that may not have been present at the time the measurements were made. The Contractors should be aware that groundwater level fluctuations may affect methods of construction.

D. Subsurface exploration, soil and rock data are for the general information of the Contractors. The Contractors are obligated to examine the site, review boring and test pit

logs, all available information and records of explorations, investigations and other pertinent data for the site, and then based upon their own interpretations and investigations decide the character of material to be encountered and excavated, the suitability of the materials to be used for backfilling and such other purposes, the groundwater conditions, difficulties or obstacles likely to be encountered, and other conditions affecting the work. The subsurface data is accurate only at the particular locations and times the subsurface explorations were made. No other warranty either expressed or implied by the Owner, Engineer or their agents is made as to the accuracy of the subsurface information and data shown on the drawings or presented in the Contract Documents.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

# SECTION 00 31 43

# PERMITS

## PART 1 – GENERAL

### 1.01 DESCRIPTION:

This Section provides specific information and defines specific requirements of the Contractor regarding the preparation and acquisition of permits required to perform the work of this project.

### 1.02 RELATED WORK:

A. Section 01 10 00, SUMMARY

B. Section 01 14 19.16, DUST CONTROL

C. Section 02 41 22, UTILITY ABANDONMENT

D. Section 31 23 00, EARTHWORK

E. Section 31 23 19, DEWATERING

### 1.03 GENERAL REQUIREMENTS:

A. The Owner has obtained or will obtain and pay for the permits listed below, which are required for this project. The Contractor shall assist in obtaining certain permits, as indicated. The Contractor shall obtain and pay for all other permits required, as defined under the Permits subsection of Section 00 07 10, GENERAL CONDITIONS.

| Permits by Owner | Status |
|---|---|
| Building Permit | * |
| Backflow Preventers | * |
| Village Board Approval | (Completed) |
| State Pollution Discharge Elimination System (SPDES) General Permit | * |

*Contractor shall prepare permit application and obtain the permit after contract is awarded, bearing all expenses. Owner will pay for and/or waive the permit application fee, if applicable.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS:

A. The Contractor shall perform the work in accordance with the Contract Documents, including the attached permits/order of conditions, and any applicable municipal requirements.

B. Prior to commencing any construction activities, the Contractor shall demonstrate to the Owner and the Engineer, through on-site inspection and submitting copies of permits or approvals, that it is in full compliance with the terms and conditions of all permits specified herein. The Contractor shall maintain full compliance with all permits throughout the performance of the work, and upon request, grant access to permitting authorities to inspect the site for the purpose of verifying such compliance.

END OF SECTION

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# SECTION 01 10 00
# SUMMARY

## 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.

### 1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work under other contracts.
4. Products ordered in advance.
5. Owner-furnished products.
6. Use of premises.
7. Owner's occupancy requirements.
8. Work restrictions.
9. Specification formats and conventions.

B. Related Sections include the following:

1. Division 1 Section "Summary of Multiple Contracts" for division of responsibilities for the Work.
2. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: New DPW Facility

1. Project Location: 220 Heatherdell Road, Ardsley, NY 10502

B. Owner: Village of Ardsley, 507 Ashford Avenue, Ardsley NY 10502

C. Architect: Weston & Sampson, PE, LS, LA, PC, 1 Winners Circle, Albany NY 12205

D. Construction Manager: Calgi Construction Company, Incorporated, 56 Lafayette Ave, Ste 350, White Plains, NY 10603

1. Construction Manager has been engaged 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.

E. Project Coordinator: The Construction Manager has been appointed by Owner to serve as Project Coordinator.

F. The Work consists of the construction of a new DPW Facility. The work generally includes the work described in Division 00 through Division 34, the Appendices, and the Drawings.

1.4 TYPE OF CONTRACT

A. Project will be constructed under Multiple Prime Contracts. See Division 1 Section "Summary of Multiple Contracts" for a description of work included under each separate contract. Contracts for this Project include the following:
   1. General Construction Contract No. 1811-001
   2. Plumbing Contract No. 1811-002
   3. Fire Protection Systems Contract No. 1811-003
   4. Mechanical Contract No. 1811-004
   5. Electrical Contract No. 1811-005

1.5 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with other separate Prime 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 other separate Prime Contracts.

B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

   1. Telecommunications Contracts: separate contracts will be awarded to provide telephone, data, security, AV, and special fire department communications systems.

1.6 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1.7 USE OF PREMISES

A. General: Each Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Each Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

   1. Driveways and Entrances: Keep driveways 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. Coordinate site work with Construction Manager to limit interruptions in access.

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.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7:30 a.m. to 8:00 p.m., Monday through Friday, except as otherwise indicated.
1. Weekend and Holiday Hours: Work shall be generally performed between the hours of 10:00 a.m. to 5:00 p.m., except as otherwise indicated.
2. Early Morning Hours: Comply with the local noise ordinance for work performed before 10:00 am and after 5:00 pm and on weekends and holidays.
3. All common use temporary facilities and controls must be available for use by the Contractor, separate contractors, their subcontractors and sub-subcontractors, the Owner, Architect, Construction Manager, their agents, and employees, during On-Site Work Hours.
4. Contractors shall not track dirt on to the Village's streets. Any construction debris that ends up on the Village's streets beyond limits of disturbance noted in the drawings shall be cleaned up on the same day that it was deposited.

1.9 WORK SEQUENCE

A. Coordinate construction schedules and operations with the construction manager

B. Conduct work to provide the least possible interference with the activities of the Owner's personnel

1.10 CONTRACTOR ACCOUNTIBILITY

A. Each Contractor is responsible for completion of its portion of the Work in a timely fashion to allow use of completed facilities. Costs incurred by Owner resulting from failure of Contractor to meet the obligations of timely completion of the Work as stated above, will be the responsibility of the Contractor, and liquidated damages will be assessed to the delinquent Contractor's account as stipulated in the Agreement.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 41-Division format and CSI/CSC's "Master Format" numbering system.

1. 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:

1. 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.

2. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

# SECTION 01 12 50- SUMMARY OF MULTIPLE CONTRACTS

## 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 a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Related Sections include the following:

1. Division 1 Section "Summary" for the Work covered by the Contract Documents, restrictions on use of the premises, Owner-occupancy requirements, and work restrictions.
2. Division 1 Section "Project Coordination" for general coordination requirements.
3. Division 1Section "Temporary Facilities and Controls" for specific requirements for temporary facilities and controls.

### 1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather-tight; exterior walls are insulated and weather-tight; and all openings are closed with permanent construction or substantial temporary closures.

### 1.04 COORDINATION

A. Project Coordinator shall be responsible for coordination between the General Construction Contract, Fire Suppression Contract, Plumbing Contract, Mechanical Contract and Electrical Contract.

1. Construction Manager shall act as Project Coordinator.

### 1.05 PROJECT COORDINATOR

A. Project Coordinator: Full-time Project Coordinator.

1. Coordination activities of Project Coordinator include, but are not limited to, the following:
   a) Provide overall coordination of the Work.
   b) Coordinate shared access to workspaces.
   c) Coordinate product selections for compatibility.
   d) Provide overall coordination of temporary facilities and controls.
   e) Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
   f) Coordinate construction and operations of the Work with work performed by each contract and Owner's construction forces.
   g) Coordinate preparation of Coordination Drawings prepared by each contractor to coordinate their work with each other.
   h) Coordinate sequencing and scheduling of the Work. Include the following:
      i. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with separate Prime Contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.

ii. Review the individual schedules provided by the Multiple Prime Contractors and incorporate the activities of the owner and architect. Provide amended schedules to the contractor for General Construction who shall then prepare the overall Master Schedule.

iii. Distribute copies of the Master Schedule to the Architect, Owner, and separate Prime Contractors.

i) Provide photographic documentation.

j) Coordinate quality-assurance and quality-control services specified in Division 1 Section "Quality Requirements."

k) Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.

l) Coordinate cutting and patching. m.

m) Coordinate protection of the Work.

n) Coordinate completion of interrelated punch list items.

o) Coordinate preparation of Project Record Documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

p) Collect Record Specification Sections from other contractors, collate Sections into numeric order, and submit complete set.

q) Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

r) Coordinate sharing access to workspaces by plumbing, fire suppression systems, mechanical, and electrical contractors.

s) Coordinate installation of plumbing, fire suppression systems, mechanical and electrical work into limited spaces.

## 1.06 GENERAL REQUIREMENTS OF MULTIPLE PRIME CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work, names and terminology on Drawings and in Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the Work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
2. Local custom and trade union jurisdictional settlements do not control the scope of the Work of each contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected contractors shall negotiate a reasonable settlement to avoid or minimize interruption and delays.
3. Excavation and Back fill of Trenches for the Work of each contract shall be provided by each contract for its own Work to 5"-0" outside the building footprint. Electrical Contract. to provide excavation and backfill of their trenches beyond the 5'- 0” If line.
4. Cutting and Patching: Provided by each contract for its own Work.
5. Through-penetration firestopping for the Work of each contract shall be provided by each contract for its own Work.
6. Each Prime Contract is required to coordinate openings in any new walls and roof with the General Construction Contract.
7. Within fourteen (14) working days after coordinated construction schedule has been re-

ceived from Project Coordinator, review and submit any and all comments, amendments to, and/or acceptance of said schedule. Project Coordinator shall reissue amended schedule as necessary showing construction operations sequenced and coordinated with overall construction.

8. Project closeout requirements.

B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the Work.

C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Division1 Section "Temporary Facilities and Controls," each contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, and costs and use charges associated with each facility.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own field office, complete with necessary furniture, utilities, telephone and internet services. Electrical service shall be brought in from temporary panel located 100 feet within property line to own field office.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. Hoisting facilities for its own construction activities.
7. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary or other harmful waste materials.
8. Progress cleaning of its own areas on a daily basis.
9. Temporary fire-protection equipment including fire extinguishers.
10. Secure lockup of its own tools, materials, and equipment.
11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

D. Temporary Heating, Cooling, and Ventilation: Each Contractor is responsible for temporary heating, cooling and ventilation required for own work. Owner will pay for utility-use charges.

E. Use Charges: Comply with the following:

1. Water Service: The Owner shall pay the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
2. Electric Power Service: Owner shall pay the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site with the following conditions:
   a) The Owner shall pay for electric energy for temporary light and power except electric energy requiring more than single phase 400 amp service required for temporary trailers for duration of the project.
   b) Any requirement for electric energy shall be provided by separate sources and completely paid for by each Contractor requiring such power until primary service is installed.

## 1.07 GENERAL CONSTRUCTION CONTRACT

A. Work in the General Construction Contract includes, but is not limited to, the following:

1. Work is outlined on Drawings with the Sheet Identifiers "EQ," “G," “C”, “A” and "S"

and includes any and all interfacing work shown elsewhere on the remaining Contract Drawings: “FP,” “P,” “M,” “E,” and “T.”.

2. Preparation of coordination drawings, for use by other trades, in compliance with Division 1 Section "Administration Requirements":
    a) Project Coordinator will allocate applicable portions of coordination drawings to the General Construction Contract, Fire Suppression Contract, Plumbing Contract, Mechanical Contract and Electrical Contract for functional and spatial relationships of components of architectural, structural, civil, mechanical and electrical systems.
    b) Indicate required installation sequences if necessary.
    c) General Contractor will be responsible for site coordination drawings, site logistic plan and construction implementation plan.
3. Preparation of overall Master Schedule upon completion of initial coordination meeting convened by the Project Coordinator. Update the Master Schedule monthly through project completion.
4. Site preparation including, but not limited to, clearing, grubbing and earthwork as well as excavation for the building and building utilities 5’-0” outside building perimeter and related earthwork.
5. Site improvements including, but not limited to, roadways, drainage structures, parking lots, pedestrian paving, lawn areas, landscaping, site development furnishings and equipment
6. All Building Utilities: Domestic Water Services, Fire Water Service and Gas Service to 5’-0” outside building foundation walls
7. Concrete Utility Slab-on-Grade for Generator, Transformer including required Bollards
8. All Retaining Walls,
9. All Slabs-on-grade and Stairs-on-grade outside of building footprint, including earthwork and insulation.
10. Site layout including verifying layout information shown on Drawings, in relation to the property survey and existing benchmarks. Locate and lay out reference points as indicated on Site drawings in Contract Documents.
11. Construction Layout including verifying layout information shown on Drawings, in relation to property survey and existing benchmarks. Locate and lay out reference points and control lines and levels for structures, building foundations, column grids, and floor levels, including control lines and levels required for fire suppression, plumbing, mechanical and electrical work from a starting point designated as per the Civil Drawings.
12. Foundations including footings and foundation walls.
13. Contractor must employ a licensed surveyor to perform building layout and to provide certification of location of completed foundation anchors. Provide via the required Submittals process a certified anchor bolt survey upon completion of all foundation work and prior to the start of steel erection. Upon completion of all sub/slab plumbing line installations, perform an as-built survey and provide a certified drawing locating all sub-slab lines including their relationships to all interior and exterior walls.
14. Interior Slab-on-grade, including earthwork and insulation.
15. Metal Panels CMU and required Back-up on all exterior / interior walls, columns, etc. with all necessary reinforcing, ties, etc.
16. Below-Grade building construction, including excavation, backfill and thermal and moisture protection.
17. Superstructure, including floors, mezzanine and roof construction.

18. Exterior enclosure, including walls, parapets, doors, windows and louvers, overhead doors and controls
19. Roofing, including coverings, flashings, metal panels, penetration booths from the pre-manufactured metal building supplier, gutters, snow guards and roof specialties
20. Interior construction, including partitions, doors, interior glazed openings and fittings. Interior finishes including supports and hangars installed by other trades.
21. Fire-protection specialties
22. Stairs, including railings and finishes
23. Interior finishes, finish carpentry, architectural woodwork and built –in casework. Interior and Exterior Impact protection and bollards.
24. Conveying systems, including elevator(s)
25. Equipment noted as supplied by General Contractor as well as equipment noted to be supplied by Owner and installed by Genera Contractor.
26. Furnishings, including casework and floor mats.
27. Final property survey.
28. Final cleaning as specified in Section "Execution and Closeout Procedures."
29. Miscellaneous specialties including, but not limited to the following:
    a) Visual display surfaces and casework
    b) Blocking for roof curbs, plumbing fixtures, etc. as required.
    c) Toilet and bath accessories
    d) Toilet Compartments
    e) Lockers and Gear Lockers
    f) Installation of necessary / required access doors provided by other Prime Contractors
30. Kitchen Cabinets, Stove, Refrigerator, Washer, Dryer etc.

B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:
1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract, Fire Suppression Systems Contract, Mechanical Contract, and Electrical Contract.
2. Construction Manager’s field office and supplies, including weekly janitorial services.
3. Trenching for all utilities, except electrical, by General Contractor up to 5’-0” outside of building perimeter.
4. Stormwater control.
5. Temporary roads and paved areas.
6. Site storm control and drainage.
7. Site sanitary sewage
8. Un-piped temporary toilet fixtures and wash facilities, including disposable supplies.
    a) Provide minimum of three temporary toilet fixtures, inclusive of one located at the field offices, for common use and two located within the construction site area where necessary for common use for the entire Contract time. Provide additional as necessary. Maintain and clean temporary toilets as required.
9. Dewatering facilities and drains, unless required solely for the Work of another contract.
10. Excavation support and protection, unless required solely for the Work of another contract.
11. Remove snow and ice from construction areas as required to minimize accumulations. Maintain safe, uninterrupted access to all construction areas.
12. Project identification and temporary signs.

13. Barricades, warning signs, and lights.
14. Site /Building enclosure fence and lockup as necessary.
15. Security enclosures and lockup.
16. Site / Building Environmental protection.
17. Temporary enclosure for building exterior, except as indicated.
18. Until permanent stairs are available, provide temporary stairs where ladders are not adequate, including to roofs.
19. Pest control. Provide pest control inspection at project closeout as indicated in Division 1 Section “Execution and Closeout Requirements."
20. General waste disposal facilities.
21. Temporary fire-protection equipment.
22. Environmental protection.
23. Temporary water freeze protection structure

1.08 FIRE-SUPPRESSION SYSTEMS CONTRACT

A. Work in the Fire Protection Systems Contract includes, but is not limited to, the following:
   1. Work is outlined on Drawings with the Sheet Identifier "FP," and includes any and all interfacing work shown elsewhere on the remaining Contract Drawings: "EQ", “G," “C,” "A," “S,” “P,” “M, “E”” and “T”.
   2. Preparation of coordination drawings, for use by other trades, in compliance with Division 1 Section "Administration Requirements."
      a) Project Coordinator will allocate applicable portions of coordination drawings to the Site Contract, General Construction Contract, Plumbing Contract, Electrical Contract, and Fire Protection Systems Contract for functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b) Indicate required installation sequences if necessary.
   3. Wet-pipe, sprinklers, valves, piping, and risers.
   4. Check valve assemblies and connections to water service.

1.09 PLUMBING CONTRACT

A. Work in the Plumbing Contract includes, but is not limited to, the following:
   5. Work is outlined on Drawings with the Sheet Identifier "P" and "C", and includes any and all interfacing work shown elsewhere on the remaining Contract Drawings: "EQ”,“G," "A," “S,” “FP,” “M, “E”” and “T”.
   1. Preparation of coordination drawings, for use by other trades, in compliance with Division 1 Section "Project Management and Coordination."
      a) Project Coordinator will allocate applicable portions of coordination drawings to the Site Contract, General Construction Contract, Plumbing Contract, Electrical Contract, and Fire Protection Systems Contract for functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b) Indicate required installation sequences if necessary.

2. Gas distribution.
3. Plumbing fixtures, including RPZ and DCDA
4. Domestic water distribution.
5. Sanitary waste.
6. Stormwater drainage to 5'-0" outside building perimeter.
7. Plumbing connections to equipment furnished by the General
8. Construction Contract, Fire Suppression Contract, Mechanical Contract and Electrical Contract.

B. Temporary facilities and controls in the Plumbing Contract include, but are not limited to, the following:
   1. Piped water service from point of connection to proposed facility, including, but not limited to, temporary standpipes and hoses for fire protection, and hose-bib, backflow-prevention devices.
   2. Plumbing connections to proposed systems and temporary facilities and controls furnished by the General Construction Contract, Fire Suppression Contract, Mechanical Contract and Electrical Contract.

1.10 MECHANICAL CONTRACT

A. Work in the Mechanical Contract includes, but is not limited to, the following:
   1. Work is outlined on Drawings with the Sheet Identifier "M," and includes any and all interfacing work shown elsewhere on the remaining Contract Drawings: "EQ", “G," “C,” "A," “S,” “FP,” “P, “E” and “T”.
   2. HVAC systems and equipment including rooftop equipment curbs and related vibration control curbs.
   3. HVAC instrumentation and controls.
   4. HVAC testing, adjusting, and balancing.
   5. Building automation system.
   6. Preparation of coordination drawings, for use by other trades, in compliance with Division 1 Section "Administration Requirements.”
      a) Indicate elevations of HVAC systems (including piping and ductwork) with reference to finish floor elevations.
      b) Project Coordinator will allocate applicable portions of coordination drawings to the General Construction Contract, Fire Suppression Contract, Plumbing Contract, Electrical Contract, and Fire Protection Systems Contract for functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      c) Indicate required installation sequences if necessary.
   7. Mechanical connections to equipment furnished by the General Construction Contract, Fire Suppression Contract, Plumbing Contract and Electrical Contract.

## 1.11 ELECTRICAL CONTRACT

A. Work in the Electrical Contract includes, but is not limited to, the following:
   1. Work is outlined on Drawings with the Sheet Identifiers "E", “C” and “T” and includes any and all interfacing work shown elsewhere on the remaining Contract Drawings: "EQ", “G," ,"A," “S,” “FP,” “P”, and “M”.
   2. Preparation of coordination drawings, for use by other trades, in compliance with Division 1 Section “Administration Requirements"
      a) Project Coordinator will allocate applicable portions of coordination drawings to the General Construction Contract, Fire Suppression Contract, Plumbing Contract, Mechanical Contract and Electrical Contract, for functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b) Indicate required installation sequences if necessary.
   3. Site electrical distribution.
   4. Site lighting.
   5. Electrical service and distribution.
   6. Exterior and interior lighting.
   7. Special electrical systems, including the following:
      a) Uninterruptible power supply systems.
      b) Packaged engine generator systems.
      c) Battery power systems.
      d) Lightning protection systems
      e) Cathodic protection.
      f) Fire alarm system.
      g) Grounding
   8. Electric wiring for fire suppressing system at kitchen exhaust hood system actuation and exhaust response in accordance with local codes, control wiring, and contactors.
   9. Electrical connections to equipment furnished by the General Construction Contract, Fire Suppression Contract, Plumbing Contract and Mechanical Contract.
   10. Underground utility duct bank, electric, communications, etc and associated pull boxes, underground utility manholes, conductors and transformer pad etc.

B. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:
   1. Temporary electric power service of single phase 400 amp to a distribution panel within Construction Site area as well as area of Field Office(s), not more than 100 ft. in from property line.
   2. Electric power service and electric distribution.
   3. Lighting, including site lighting.
   4. Provide temporary telephone service, electronic communication service, including internet service, and electric power for the Construction Manager field office.
   5. Electrical connections to proposed systems and temporary facilities and controls furnished by the General Construction Contract, Fire Suppression Contract, Plumbing Contract and Mechanical Contract.

END OND OF SECTION 011250

# SECTION 01 14 19.16

# DUST CONTROL

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

A. This Section specifies requirements for controlling dust generated during work of this Contract. Work activities requiring special attention to dust control include earthwork demolition, stockpiling, compacting, loading and removal of demolition debris from the site, and earthwork.

B. The Contractor is responsible for control of dust at all times during work of this Contract, 24 hours per day, 7 days per week, including non-working hours, weekends, and holidays.

### 1.2 BASIS OF PAYMENT

A. Construction of the new public works facility.

## PART 2 - PRODUCTS

### 2.1 DUST SUPPRESSION AGENTS:

A. Dust suppression wetting agents shall be water soluble, non-toxic, non-reactive, non-volatile, and non-foaming.

B. Soil stabilizer shall be a sprayable organic or inorganic tackifier.

### 2.2 BARRIERS, SCREENS, AND COVERS:

A. Wind screens shall be a durable fabric mesh of 50 percent porosity, attached to demolition site fence.

B. Wind barriers shall be solid wood fences, solid durable fabric attached to temporary site fence, or other solid barriers intended to block the passage of wind.

C. Covers for stockpiles shall be plastic tarps. Contaminated soil covers shall be 20-mil. polyethylene sheeting or 10-mil. nylon reinforced polyethylene sheeting. The stockpile shall be placed on 40 mil. polyethylene sheeting.

### 2.3 CALCIUM CHLORIDE:

A. Calcium chloride shall conform to the requirements of AASHTO-M 144, Type I or Type II and Specification for Calcium Chloride, ASTM D98. The calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.

B. Calcium chloride failing to meet the requirements of the aforementioned specifications or that which has become caked or sticky in shipment, may be rejected by the Engineer.

2.4 WATER:

A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

## PART 3 - EXECUTION

3.1 CONSTRUCTION SITE DUST CONTROL – GENERAL:

A. Wet suppression shall be used to provide temporary control of dust. Several applications per day may be necessary to control dust depending upon meteorological conditions and work activity. The Contractor shall apply wet suppression on a routine basis as necessary or required by the Engineer, to control dust. At a minimum, wet suppression shall be applied to demolition debris, excavated material, aggregate piles, and exposed soils and dirt.

1. Wet suppression consists of the application of water or a wetting agent in solution with water. Ensure wetting agent is not used on plantable soils.
2. Wet suppression equipment shall consist of sprinkler pipelines, tanks, tank trucks, or other devices capable of providing regulated flow, uniform spray, and positive shut-off.
3. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.
4. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.
5. The Contractor shall provide the necessary means to retain on-site all water runoff generated by dust control and dispose of such water in accordance with the requirements of the appropriate regulatory agencies. The Contractor shall be responsible for providing water, a means of disposal, necessary permits, and all appurtenances required to control dust.

B. Calcium chloride shall be used to control dust instead of wet suppression when freezing conditions exist. Calcium chloride shall be uniformly applied by a mechanical spreader at 1 ½ pounds per square yard, unless otherwise required by the Engineer. Ensure vegetation or soil to be used for vegetation is not treated.

C. The use of petroleum products for dust suppression is prohibited in this Contract.

D. Provide wind screens and wind barriers in locations where they would be effective in minimizing wind erosion and spread of dust. Locations shall be submitted as part of the Contractor's Dust Control Plan. The Contractor shall keep wind screens and barriers in good repair for the life of the Contract.

E. The Contractor is responsible for daily clean-up of paved areas affected by the work of this Contract. A wet spray power vacuum street sweeper shall be used on paved areas. Dry power sweeping is prohibited.

3.2 CONTROL OF EARTHWORK DUST:

A. During batch drop operations (i.e., earthwork with front-end loader, clamshell bucket, or backhoe) the free drop height of excavated or aggregate material shall be reduced as much as practical to minimize the generation of dust.

B. To prevent spills during transport, freeboard space shall be maintained between the material load and the top of the truck cargo bed rail.

3.3 CONTROL OF STOCKPILE DUST:

A. The Contractor shall use the following methods to control dust and wind erosion of active and inactive stockpiles:

1. Wet suppression without wetting agent during active stockpile load-in, load-out, and maintenance activities.
2. Soil stabilizers applied to the surface of inactive stockpiles.
3. Polyethylene tarps on stockpiles shall be placed both below and on top of stockpiles, and secured with sandbags or an equivalent method to prevent the cover from being dislodged by the wind. The Contractor shall repair or replace covers whenever damaged or dislodged, at no additional cost to the Owner.
4. The tarps shall be bermed 12-inches high at all edges to prevent any infiltration of storm water or exfiltration of leachate.

B. The methods to be used shall be submitted to the Engineer as part of the Dust Control Plan.

3.4 DEMOLITION DUST CONTROL MEASURES:

A. The Contractor shall use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in the air to the lowest practical level. Sufficient water shall be supplied for the cutting operations, demolition-related debris, and site compacting to meet Federal, State, and local air-quality regulations and to minimize dust during demolition.

B. Closed chutes shall be used for the handling of debris. Dropping or throwing of debris is prohibited.

C. Debris shall not be stockpiled. Debris shall be removed promptly from the site.

D. During transport of debris, the truck cargo area shall be securely covered.

END OF SECTION 01 14 19.16

# SECTION 01 23 00
# ALTERNATES

## 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.

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

### 1.3 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.

### 1.4 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. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. 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

3.1 SCHEDULE OF ALTERNATES

A. **Alternate No. 1: ADD extended Mezzanine 2A in Vehicle Storage Area [118]**

This Alternate includes: The General Contractor, Fire Protection Contractor and Electrical Contractor shall provide and assemble/install all materials, finishes and equipment required for the installation of the extended Mezzanine and stair, as shown on details #1/S121A and #3/S301, drawings E103, E104, E201, E202, E203, E204 and the associated Fire Protection and Architectural drawings. This work is in addition to the base bid mezzanine and stair.

Related work to support this Alternate is part of the Base Bid and includes: Structural capacity to support the suspended Mezzanine loads, all necessary electrical circuits, conduit, and branch wiring to support the installation of lighting at the underside of the Mezzanine and exit signs and convenience power receptacles at the upper level of the Mezzanine; and all necessary Fire Protection capacity, main piping and connection points to support the installation of sprinklers at the underside of the Mezzanine shall be included in the Base Bid.

**B. Alternate No. 2: ADD Fuel Island**

This Alternate includes: The General Contractor and Electrical Contractor shall provide one complete fuel island, including gasoline and diesel above-ground fuel tanks, dispensers, controls, control and alarm wiring and conduit, alarms, tank monitoring system, fuel management system, concrete mounting pads and metal curbing, protective bollards, containment pad, fire suppression system, lighting, canopy foundations, exterior electrical panel and enclosure, power and signal connections, etc., as shown on drawings EQ201, EQ202, EQ203, EQ206, E002 and detail #4/E503 and as otherwise required for a complete, code-compliant and operational installation.

Related work to support this Alternate is part of the Base Bid and includes: All necessary electrical capacity, signal and fire protection capacity and exterior conduit to the main building shall be included in the Base Bid. ***See Alternate 2a, below, for contingent ADD Fuel Island Canopy Alternate.***

**C. Alternate No. 2a: ADD Fuel Island Canopy**

This Alternate includes: The General Contractor shall provide one fuel island canopy. Canopies shall be designed to the standards outlined in specification 13 34 23 – PRE-ENGINEERED CANOPY. The location, limits, and details of the canopy and the canopy fire suppression systems shall be as shown on EQ201, EQ204, EQ205 and EQ206,and as otherwise required for a complete, code-compliant and operational installation. NOTE: If this Alternate No. 2a is chosen, the standalone fire suppression systems with cylinder cabinets for the fuel island shall not be required. The fire suppression support frame and pole-mounted lights shall not be required as indicated on the Equipment drawings.

Related work to support this Alternate is part of the Base Bid and Alternate 2 and includes: All necessary electrical capacity, signal and fire protection capacity and exterior conduit shall be included in the Base Bid Canopy foundations are included under Alternate 2. ***This Alternate is otherwise valid only if Alternate No. 2 is selected.***

**D. Alternate No. 3: DEDUCT Storage Basement [001] and Shop Extension [119]**

This Alternate Includes**:** The General Contractor and all Trade Contractors shall delete all elements of the Work required for the construction of the basement and main floor areas between column lines B-C and 14-17, as shown on details#2/C101, #2/C102, #2/C103, #3/C506, #4/C506, drawings S102A, S112A, S132A, the associated Civil, Architectural and FP/MEP drawings and as described in the technical specifications. If this DEDUCT Alternate is taken, provide construction per details 1 & 2 / A208 and the associated Civil, Structural and FP/MEP drawings.

Related work to support this Alternate is part of the Base Bid and includes: The complete construction of the Storage Basement and Shop Extension is part of the Base Bid, as shown on drawings S102, S110, S112, S132 and the associated Civil, Architectural and FP/MEP drawings further described in the technical specifications.

**E. Alternate No. 4: ADD 5-ton Bridge Crane (MB-1)**

This Alternate includes: The general contractor shall provide an underhung 5-ton bridge crane with electric cable hoist and shall provide all equipment and assembly necessary for a complete and operable system. Contractor and crane manufacturer, shall include all supplemental framing, bracing and hangers necessary for connecting to the building roof steel frame. The 5-ton bridge crane shall constructed to the minimum requirements, dimensions and limits as specified in Section 14 22 13 and shown on drawings EQ101, EQ102, E101 and E701. Drawings S131 and detail 3/S302 provide additional information on the crane, the necessary supports, and the overall ceiling configuration.

Related work to support this Alternate is part of the Base Bid and includes: Electrical contractor shall provide disconnect switch all electrical conduit and conductors to the switch for use with the 5-ton bridge crane as Base Bid. Electrical conduit and conductors between the disconnect and the 5-ton bridge crane, including final connection to the crane, shall be part of this Alternate. Contractor shall coordinate with building manufacturer to provide the necessary structural capacity and steel support for the crane as part of the Base Bid, as indicated on the drawings referenced above.

**F. Alternate No. 5: ADD Fluid Distribution System**

This Alternate includes: The general contractor shall provide all fluid/lubrication system equipment included in specification 11 11 29 – LUBRICATION DISPENSING SYSTEM and assemble/install as necessary for a complete and operable system. Equipment shall be located as shown on EQ101 and additional details are provided on drawing EQ103.

Related work to support this Alternate is part of the Base Bid and includes: All electrical and plumbing (compressed air) service connections to fluid distribution system items shall be Base Bid.

**G. Alternate No. 6: ADD Standby Generator**

This Alternate includes: The Electrical contractor shall provide and assemble/install all equipment included and otherwise referenced in Specification 26 32 13 – POWER GENERATION – GENERATOR, AUTOMATIC TRANSFER SWITCH AND ACCESSORIES and shown on drawings C101, E002 and details #3/E102, #3/E501 and #4/E503 and as otherwise necessary for a complete and operable system. Exterior equipment pad, equipment, controls, etc., shall be located as shown on the drawings.

Related work to support this Alternate is part of the Base Bid and includes: The ATS (Automatic Transfer Switch) and all necessary conduit for electrical power and signal, including to interior power, control and/or monitoring locations, shall be included in the Base Bid.

**H. Alternate No. 7: ADD All Parts Storage Shelving and Workbenches**

This Alternate includes: The General Contractor shall provide and assemble/install all workbenches, shelving units, and other equipment designated as Alternate No.7 in specification 12 40 00 – EQUIPMENT, FURNISHINGS, AND ACCESSORIES such that they complete and operable. The location of this equipment is shown on drawings EQ101 and EQ102.

Related work to support this Alternate is part of the Base Bid and includes: N/A

**I. Alternate No. 8: DEDUCT Building Management System**

This Alternate includes: The Mechanical contractor shall remove the Building Management System from all units shown on M-800 series drawings and specification section 23 09 23 BUILDING MANAGEMENT SYSTEM DDC LOGIC. The mechanical contractor shall provide standalone programmable thermostatic controls for all equipment and provide any necessary wiring to create standalone systems.

Related work to support this Alternate is part of the Base Bid and includes: None

END OF SECTION 01 23 00

SECTION 01 25 00- CONTRACT MODIFICATIONS

## PART 1 GENERAL

1.1 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.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
1. Division 1 Section "Unit Prices" for administrative requirements for using unit prices.
2. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 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."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect 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. Proposal Requests issued by Architect or Construction Manager are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 3-days 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 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.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes 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 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 Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests or similar acceptable form.

1.5 ALLOWANCES **N/A**

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 14 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

B. See Article 7 in General Conditions and Supplementary General Conditions.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect or Construction Manager may issue a Construction Change Directive on EJCDC Document 1910-8-F or in similar format. 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 012500

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SECTION 01 27 00

UNIT PRICES

## 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.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:
   1. Division 1 Section below contains requirements that relate directly to unit prices.
   2. Division 1 Section “Allowances” for procedures for using unit prices to adjust quantity allowances
   3. Division 1 Section “Contract Modification Procedures” for procedures for submitting and handling Change Orders

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

B. Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in section 4 of this specification. Mobilization does not include the start of work at a specific area on the project site while the contractor is present at other areas immediately prior to, during or following the work.

**1.4** PROCEDURES

A. Unit price shall be used when and if required by Owner through Architect for all additions and deletions to the Contract quantities and shall be inclusive of furnishing and installing all necessary material, plus costs for delivery, insurance, labor, applicable taxes, overhead, profit, equipment, hoisting, scaffolding, trucking, handling, submissions, layout, permits, coordination, hangers, inserts, couplings, testing, delivery, supervision, etc. as per change orders, and shall remain installed in quantities and locations as approved by the Architect/Construction Manager.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

**PART 2-PRODUCTS (Not Used)**

**PART 3- EXECUTION**

3.1 LIST OF UNIT PRICES

**A. <u>CONTRACT No. 1 – General Construction Contract</u>**

1. <u>Trench Rock Excavation</u>
   a. Per cubic yard of Trench rock excavation according to Division 31 Section "Earthwork". Include replacement with approved materials.
   b. Volume of rock actually removed, measured in original position, but not to exceed the following:
      1) 24 inches outside of concrete forms
      2) 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide

2. <u>Bulk Rock Excavation</u>
   a. Per cubic yard of bulk rock excavation according to Division 31 Section "Earthwork". Include replacement with approved materials.
   b. Volume of rock actually removed, measured in original position, but not to exceed the following:
      1) 24 inches outside of concrete forms other than at footings
      2) 12 inches outside of concrete forms at footings
      3) 6 inches outside of minimum required dimensions of concrete cast against grade
      4) Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments
      5) 6 inches beneath bottom of concrete slabs-on-grade

3. <u>Exterior Bulk Excavation</u>
   a. Per cubic yard of Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect, according to Division 31 Section "Earthwork". Include work outside the perimeter of the building structure.
   b. Volume of material actually removed, measured in original position.

4. <u>Exterior Trench and Culvert Excavation</u>
   a. Per cubic yard of Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect, according to Division 31 Section "Earthwork". Include the excavation for and backfill of all culverts, pipe lines, and other minor structures outside the perimeter of the building structure, including but not limited to leaching basins, catch basins, field inlets, manholes and drop inlets.

b. Volume of material actually removed, measured in original position, but not to exceed the following as applicable:
    1) Bottom Limits: The elevation of the bottom payment line shall be the invert elevation of the pipe, conduit, or culvert. For pipes, conduits, or culverts of nominal horizontal dimensions of 12 in. to 144 in., the width of the excavations at the bottom payment line shall be the nominal inside horizontal dimension of the pipe, conduit, or culvert plus 48 in., or three times the nominal inside horizontal dimension, whichever is less.
    2) Side Limits: The side payment lines of the excavation shall be vertical to the bottom of payment line, regardless of whether sheeting is or is not required or used. For utility lines, exclusive of conduit and cable lines, of less than 12 in. diameter, the excavation width shall be the actual bottom width necessary, as determined by the Construction Manager, to perform the installation work required, or 40 in., whichever is less.

5. Replacement of Unsuitable On-Site Material
    a. Per cubic yard of unsuitable on-site material removed according to Division 31 Section "Earthwork". Include replacement with approved materials.
    b. Volume of unsuitable material actually removed, measured in original position.

6. Utilities Excavation
    a. Per linear foot of excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect, according to Division 31 Section "Earthwork". Include the excavation and necessary backfill required for utility piping and conduits.
    b. Length of utility actually put in place. Include the cost of furnishing all labor, materials and equipment necessary to excavate and backfill the trench and to replace any pavement, shoulder, and sidewalk courses, sub-courses, curbs, drives, lawns and other top surfaces as required to complete the work.

7. Cast-In-Place Concrete
    a. Per cubic yard of concrete beyond indicated lines and dimensions as directed by Architect, according to Division 3 Section "Cast-in-Place Concrete". Include work inside the perimeter of the building structure.
    b. Volume of material actually installed, measured in original position.

8. Concrete Slab-On-Grade
    a. Per square foot of concrete beyond indicated lines and dimensions as directed by Architect, according to Division 3 Section "Cast-in-Place Concrete".
    b. Volume of material actually installed, measured in original position.

9. Concrete Slab-On-Metal Deck
    a. Per square foot of concrete beyond indicated lines and dimensions as directed by Architect, according to Division 3 Section "Cast-in-Place Concrete".
    b. Volume of material actually installed, measured in original position.

10. Structural Steel
    a. Per ton of steel beyond indicated lines and dimensions as directed by Architect, according to Division 5 Section "Structural Steel".
    b. Volume of material actually installed, measured in original position.

11. Metal Deck
    a. Per square foot of deck beyond indicated lines and dimensions as directed by Architect, according to Division 5 Section "Steel Decking."
    b. Volume of material actually installed, measured in original position.

12. Access Doors and Frames at Gypsum Wallboard Walls and Ceilings
    a. Per complete access door installation according to Division 8 Section "Access Doors and Frames".

13. Fire Rated Access Doors and Frames at Gypsum Wallboard Walls and Ceilings
    a. Per complete fire-rated access door installation according to Division 8 Section "Access Doors and Frames".

**B. CONTRACT No. 2 – Plumbing Construction Contract**

1. Fixtures
    a. Per each type listed below. Include vacuum breakers, drains, traps, etc as per specifications:
        1) Water Closet
        2) Urinal
        3) Lavatory
        4) Drinking Fountain
        5) Mop Sink Basin
        6) Floor Drain
        7) Roof Drain
        8) Wall Hydrant
        9) Hose Bibb
        10) Emergency Eyewash

2. Backflow Prevention
    a. RPZ assembly, 1" and 2"

3. Labor
    a. Provide straight time and all applicable overtime charges for each labor division noted below:
        1) General laborer
        2) Plumber
        3) Insulator

**C. CONTRACT No. 3 – Fire Protection Systems Contract**

1. Sprinkler Head
    a. Per head of each type specified according to applicable Division 21 Sections:
        1) Pendant Concealed
        2) Pendant Exposed
        3) Upright
        4) Sidewall

2. Tamper Switch
    a. Include coordination for FA connection

3. Flow Switch
    a. Include coordination for FA connection

4. Labor
    a. Provide straight time and all applicable overtime charges for each labor division noted below:
        1) General laborer
        2) Steamfitter
        3) Insulator

**D. CONTRACT No. 4 – Mechanical Construction Contract**

1. Ductwork
    a. Per each listed below to include Duct Fittings and transitions, Duct Insulation and Duct internal Soundlining as required:
        1) Galvanized Ductwork (square, round, etc), in $/pound
        2) Plenum Ductwork, in $/pound
        3) Fire-Smoke Dampers, per sqft
        4) Volume dampers

2. Equipment
    a. 100-500 CFM HW fancoils
    b. Scheduled unit heaters
    c. Condensate pumps

3. Controls
    a. BMS Control integration and programming for all listed below:
        1) Thermostats
        2) Relays
        3) Temp Sensors
        4) Control valves as specified, sizes ½" – 4"
        5) Motorized Dampers

4. Labor
    a. Provide straight time and all applicable overtime charges for each labor division below:
        1) General laborer
        2) Steamfitter
        3) Sheet Metal Mechanic
        4) Insulator
        5) Controls Tech
        6) Draftsman

5. General
    a. Diffusers, Grilles
    b. Roof Penetrations up to 2sf
    c. Concrete housekeeping pads, in sqft
    d. Glycol, per 50gal.
    e. Refrigerant
    f. Roof Equipment support curbs

**E. CONTRACT No. 5 – Electrical Construction Contract**

1. Duplex Receptacle
    a. Per receptacle with wiring to nearest available receptacle circuit, back box, wires terminated and cover plate according to applicable Division 26 Sections.

2. Lighting Switch
    a. Per switch of each type listed below, with back box, wires terminated and cover plate according to applicable Division 26 Sections:
        1) Line voltage lighting switch
        2) Low voltage lighting switch

3. Vacancy Sensor
    a. Per sensor with back box, wires terminated and cover plate according to applicable Division 26 Sections.

4. Lighting Fixtures
    a. Per lighting fixture of each type according to applicable Division 26 Sections.

5. Empty Conduit and Junction Box for Telecommunications System
    a. Per box with conduit and fish string to above ceiling assembly according to applicable Division 26 Sections.

6. Card Reader with Associated Wiring
    a. Per complete system according to applicable Division 26 Sections.

7. Fire Life Safety Devices
    a. Per device of each type listed below with programming according to applicable Division 26 Sections:
        1) Smoke Detector
        2) Pull Station
        3) Tamper Switch
        4) Door Holder
        5) Horn / Strobe
        6) Heat Detector
        7) Fire Alarm Control Module

8. Branch Circuits
    a. Per 20 linear foot of each type listed below terminated at both ends:
        1) 2#12,1#12G-¾” C
        2) 2#10,1#10G-¾” C
        3) 4#10,1#10G-¾” C
        4) 5#10,1#10G-¾” C

9. Feeders
    a. Per linear foot of each type listed below terminated at both ends:
        1) 4#4,1#8G-1 ¼ ” C
        2) 3#2,1#6G-2” C
        3) 4#4/0,1#2G-2.5”C
        4) 4#500mcm,1#350mcmG-3½” C

10. Circuit Breakers
    a. Per each type listed below:
        1) 20A-1p breaker
        2) 30A—1p breaker
        3) 20A-2p breaker
        4) 30A-2p breaker
        5) 60A-3p breaker
        6) 80A -3p breaker
        7) 100A-3p breaker
        8) 150A-3p breaker
        9) 225A /3p breaker

11. Fire Alarm Branch Wiring
    a. Per linear foot, in conduit.

12. Fused Disconnect Switches
    a. Per each type listed below:
        1) 30 A-3p Fused Disconnect switch
        2) 60 A-3p Fused Disconnect switch
        3) 100 A-3p Fused Disconnect switch
        4) 200 A-3p Fused Disconnect switch
        5) 400 A-3p Fused Disconnect switch

END OF SECTION 01 27 00

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# SECTION 01 31 00- PROJECT COORDINATION

## PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the project coordination as specified herein, including, but not limited to, the following:
   1. General project coordination procedures.
   2. Conservation.
   3. Coordination drawings.
   4. Administrative and supervisory personnel.
   5. Cleaning and protection.

1.3 RELATED SECTIONS

A. Project Meetings - Section 01 31 19.
B. Submittal Procedures - Section 01 33 00.
C. Product Requirements - Section 01 55 00.
D. Closeout Procedures - Section 01 77 00.

**1.4** COORDINATION

A. Coordinate construction operations included in various sections of these specifications to ensure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in the 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 to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.

5. Project closeout activities.

D. Conservation: Coordinate construction operations 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 in, the work.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
   1. Show the relationship of components shown on separate shop drawings.
   2. Indicate required installation sequences.
   3. Comply with requirements contained in Section 013300, "Submittal Procedures."

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the contractor's principal staff assignments, including the superintendent and other personnel in attendance at the project site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
   1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

**PART 2 PRODUCTS**

(Not Applicable)

**PART 3 EXECUTION**

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Architect.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at substantial completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. 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. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION 01 31 00

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SECTION 01 31 19

PROJECT MEETINGS

## PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. To enable orderly review of progress during construction and to provide for systematic discussions of problems, the Construction Manager will conduct project meetings throughout the construction period.

B. In general, project meetings will be held at the job site in accordance with a mutually acceptable schedule.

C. The purpose of the project meetings is analysis of problems that might arise relative to execution of the work.

1.3 RELATED SECTIONS

A. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility as described in the General Conditions, and are not part of the agenda of project meetings.

1.4 QUALITY ASSURANCE

A. Persons designated by the Contractor to attend and participate in project meetings shall have all required authority to commit the Contractor to solutions as agreed upon in the project meetings.

1.5 SUBMITTALS

A. Agenda Items: To the maximum extent possible, advise the Construction Manager at least twenty-four (24) hours in advance of the project meeting regarding all items to be added to the agenda.

B. Minimum Agenda

1. Review work progress since last meeting.

2. Note field observations, problems and decisions.

3. Identify problems which impede planned progress.

4. Review off-site fabrication problems.

5. Develop corrective measures and procedures to regain schedule.

6. Coordinate projected progress with other prime contractors.

7. Review submittal schedules, expedite as required to maintain schedule.

C. Minutes: The Construction Manager shall compile minutes of each project meeting and shall distribute copies to the Owner and the Architect. The Construction Manager shall make and distribute such other copies as he wishes. The Architect and/or Owner may issue amendments to the minutes as necessary. Construction Manager shall issue same to other interested parties.

## PART 2 PRODUCTS

(Not Applicable)

## PART 3 EXECUTION

### 3.1 MEETING SCHEDULE

A. Coordinate with the Architect as required to establish a mutually acceptable schedule for project meetings.

### 3.2 MEETING LOCATION

A. To the maximum extent practicable, project meetings shall be held at the job site. As practicable, the General Contractor shall provide adequate space and facility including table, chairs, and lighting for proper conduct of meeting, subject to available space and the progress of the work.

### 3.3 ATTENDANCE

A. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout the construction period. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the work are involved.

END OF SECTION 01 31 19

SECTION 01 32 16

PROGRESS SCHEDULE

**PART 1 - GENERAL**

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the progress schedule as specified herein, including, but not limited to, the following:

1. Format.
2. Content.
3. Revisions to schedules.
4. Submittals.

1.3 RELATED WORK

A. Submittal Procedures - Section 01 33 00.

1.4 FORMAT

A. Sample: Review provided Preliminary Milestone Schedule at the end of Section 000900 timeline estimates and minimum category requirements

B. Prepare Schedules using a program that has been developed specifically to manage construction schedules

1. Utilitize Primavera Suretrak for Windows systems.

C. Sequence of Listings: The chronological order of the start of each item of Work.

D. Scale and Spacing: To provide space for notations and revisions.

E. Diagram Sheet Size: Maximum 24x36 inches (600x900mm) or width required

F. Sheet Size: Multiples of 11x17 inches (279.4x431.8mm)

1.5 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by Specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire Schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products and Products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision data for selection of finishes.

G. Indicate delivery dates for Owner furnished products and Products identified under Allowances.

H. Identify major milestones, including but not limited to, Project completion, punchlist, and turnover.

I. Include all procurement, off-site, and construction activities.

1. Procurement activities include: periods for submittal transmission, review, and approval; fabrication periods for major and critical trades.

J. Illustrate order and interdependence of activities and sequence of Work; how start of a given activity depends on completion of preceding activities and how completion of the activity may restrain start of following activities.

K. Provide legend for symbols and abbreviations used.

L. Show sufficient detail to allow visual checking of progress on a monthly basis.

1.6 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including the effect of changes on schedules of separate contractors.

1.7 SUBMITTALS

A. Submit initial Schedules within 14 days of date established for commencement of the Work. After review, resubmit required revised schedule within 10 days.

B. Submit revised Progress Schedule with each Application for Payment.

C. Submit one opaque reproduction and one reproducible transparency.

1.8 RECOVERY SCHEDULE

A. When periodic updates indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which the Contractor intends to regain compliance with the schedule.

B. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

1.9 DELAYS

A. Delays in the schedule will be determined through the Agreement and the General Conditions of the Contract.

1.10 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect, Clerk or both, at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

1.11 DISTRIBUTION

A. Distribute copies of reviewed Schedules to project site file, Subcontractors, suppliers, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in Schedules.

**PART 2 – PRODUCTS**

(Not Applicable)

**PART 3 - EXECUTION**

(Not Applicable)

END OF SECTION 01 32 16

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# SECTION 01 33 00- SUBMITTAL PROCEDURES

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

### 1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete submittal requirements as specified herein, including, but not limited to, the following:

1. Electrical Shop Drawings
2. Shop drawings and samples.
3. Integrated/coordinated drawings.

### 1.3 RELATED SECTIONS

A. Progress Schedule - Section 013216.

B. Operating and Maintenance Data - Section 017823.

## PART 2 PRODUCTS

**(NOT USED)**

## PART 3 EXECUTION

### 3.01 ELECTRONIC DOCUMENTS SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet – based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, an notifies addresses via email. The Construction Manager uses Procore for this purpose and the Contractor will be required to communicate all documentation through this system.

1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFI's), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders),applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.

2. Contractor is required to use this service

3. It is the Contractor's responsibility to submit documents in PDF format

4. Subcontractors and suppliers will be permitted to use the service

5. Users of the service need an email address, Internet access, and will use Procore for submission of PDF review. Access to Procore will be provided by the Construction Manager.

6. Contractor is responsible for image resolution of PDF documents, utilizing original document size; increase resolution as required to adequately present the information

7. Provide and transmit full color reproduction of PDF documents requiring color to convey intent and compliance

8. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected services is:

1. Procore

3.02 INTEGRATED DRAWINGS

A. The HVAC Contractor shall prepare a Drawing or Drawings showing duct work, heating and sprinkler piping. This Drawing shall include location of grilles, registers, etc., and access doors in hung ceilings. Locations shall be fixed by elevations and dimensions from column center lines and/or walls.

B. The HVAC Contractor shall prepare and distribute to the Site, General, Plumbing, Fire Protection and Electrical Contractors, the General Contractor, and to the Architect and Construction Manager reproducible of the above.

C. Each trade is to show their components in a different color.

D. The HVAC Contractor shall lay out on his reproducible the reflected ceiling plan, beam soffit elevations, ceiling heights, roof openings, etc.

E. The Plumbing Contractor shall lay out on his reproducible the piping, valves, clean-outs, etc., indicating locations and elevations and shall indicate the necessary access doors.

F. The Fire Suppression Contractor shall indicate on his reproducible the fixtures, large conduit runs, clearances, pull boxes, junction boxes, sound system speakers, etc.

G. The Electrical Contractor shall indicate on his reproducible the fixtures, large conduit runs, clearances, pull boxes, junction boxes, sound system speakers, etc.

H. The General Construction Contractor shall indicate on his reproducible any structural framing, ceiling hangers, etc.

I. The Construction Manager shall call as many meetings with the Contractors as are necessary to resolve any conflicts that become apparent. He will call on the services of the Consultant Engi-

neer or Architect where necessary. The Construction Manager is responsible for the coordination of the Drawing or Drawings between the Contractors.

J. On resolution of the conflicts, each Contractor shall enter his own work on the HVAC Contractor's reproducible, which shall become the master or integrated Drawings. The master reproducible shall be signed by each contributing Contractor to indicate his acceptance of the arrangement of the work.

K. A reproducible copy of the master integrated Drawing will be prepared by the HVAC Contractor. The Construction Manager will make distribution to the Contractors

L. Each Contractor shall prepare his Shop Drawings in accordance with the integrated Drawings. No work will be permitted without approved Shop Drawings. It is therefore essential that this procedure be instituted as quickly as possible.

M. Review drawings with the Construction Manager to review and resolve identified coordination drawing conflicts prior to submission to Architect.

1. Submit drawings to Architect and Engineer for approval only after coordination is completed and Contractor has initialed the completed drawings.

2. Do not begin installations affected by coordination drawings without Architect approval.

3.03 COORDINATION OF SUBMITTALS

A. Prior to submittal for Architect's review, use all means necessary to fully coordinate all material, including the following procedures:

1. Determine and verify all field dimensions and conditions, materials, catalog numbers and similar data.

2. Coordinate as required with all trades and with public agencies involved.

3. Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.

4. Clearly indicate all deviations from the Contract Documents.

B. Unless otherwise specifically permitted by the Architect, make all submittals in groups containing all associated items; the Architect may reject partial submittals as not complying with the provisions of the Contract Documents.

END OF SECTION 013300

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# SECTION 01 40 00

# QUALITY REQUIREMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility 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.

### 1.3 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. **Mockups**: 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. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

E. 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.

F. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

## 1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: 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 conflicting requirements that are different, but apparently equal, to Architect 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 before proceeding.

## 1.5 SUBMITTALS

A. Informational Submittals:

1. Testing Agency Qualifications: 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.

2. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

   a. Specification Section number and title.
   b. Entity responsible for performing tests and inspections.
   c. Description of test and inspection.
   d. Identification of applicable standards.
   e. Identification of test and inspection methods.
   f. Number of tests and inspections required.
   g. Time schedule or time span for tests and inspections.

## 1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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.

B. 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.

## 1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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.

C. 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.

D. 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.

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 product that are similar in material, design, and extent to those indicated for this Project.

F. 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 329; 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.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

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. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
2. Notify Architect and Construction Manager seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

## 1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for cancelled, retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. 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.

2. 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.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. 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 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting / Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. 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, Construction Manager, 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.

G. 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.

6. Security and protection for samples and for testing and inspecting equipment at Project site.

H. 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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## 1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections attached to this Section, and as follows:

1. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.

3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

5. Retesting and re-inspecting corrected work.

# PART 2 - PRODUCTS (Not Used)

# PART 3 - EXECUTION

## 3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: 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 revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's, reference during normal working hours.

3.2 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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

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 01 40 00

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# SECTION 01 42 00
# REFERENCES

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Abbreviations and Acronyms.

B. Definitions

C. Reference Standards.

### 1.02 ABBREVIATIONS AND ACRONYMS

A. The following list of common abbreviations are referenced in individual specification sections. This list is provided for convenience to the Contractor and is not intended to define all abbreviations which may be found in the Contract Documents.

B. Abbreviations for contract and specifications.

| | |
|---|---|
| EPA | United States Environmental Protection Agency |
| HVAC | Heating, ventilating, and air conditioning |
| IAQ | Indoor Air Quality |
| IEQ | Indoor Environmental Quality |
| MSDS | Material Safety Data Sheet |
| NIC | Not in Contract |
| OFCI | Owner Furnished, Contractor Installed |
| OFI or OFOI | Owner Furnished and Installed (Owner Furnished, Owner Installed) |
| OPM | Owner's Project Manager (as defined in Section 01 10 00) |
| VOC | Volatile Organic Compounds |

C. Abbreviations for measurements and quantities.

| | |
|---|---|
| C | Celsius |
| cm | Centimeter |
| F | Fahrenheit |
| Hrs | Hours |
| Kg | Kilogram |
| L | Liter |
| M | meter |
| $m^2$ or SM | square meter |
| $m^3$ or CM | cubic meter |
| mm | Millimeter |
| Mths | Months |
| psi | Pounds per square inch |
| t | ton |

1.03 DEFINITIONS

A. Definitions of contracting parties (Owner, Owner's Project Manager, Construction Manager, and Architect): Refer to Section 01 10 00 – PROJECT SUMMARY.

B. Definitions for terms utilized in the Contract Documents:

C. "As necessary," "as directed," "when directed," "satisfactory," "good and sufficient," "approved," or other general qualifying terms are used on the Drawings: These terms are deemed to be implicitly followed by the words, "in the opinion of the Architect," or "by the Architect," as the case may be."

D. "Addenda": written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Bidding Documents, including the Drawings and Specifications, by additions, deletions, clarifications or corrections.

E. "Approval," "approved, "approved equal," "or equal," or "other approved" means "as approved by the Architect."

F. The terms "Contractor", "General Contractor", and "Construction Manager" as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. These terms refer to the same entity.

G. The term "Day": is defined as the following:

1. The term "calendar day" is a full 24 hour period, starting from 12 AM (midnight), and including all weekends and legal holidays.
2. The term "working day" shall mean any calendar day except Saturdays, Sundays, and legal holidays at the place of the building.
3. Where the term "day" is used without the adjective of "calendar" or "working", it shall mean "calendar day".

H. The terms "Designer", "Architect", "Engineer" and "Architect/Engineer" as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. These terms refer to the same entity.

I. "Furnish and Install" or "Provide": items identified shall be furnished and installed under this Contract. The term "Furnish", when used separately, shall mean that the items referred to shall be furnished, only. Similarly the term "install", when used separately, shall mean that the items referred to shall be installed, only.

J. "Knowledge," "recognize" and "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows (or should know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill and diligence required by the Contract Documents. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a Contractor familiar with the Project and

exercising the care, skill and diligence required of the contractor by the Contract Documents.

K. "Not in Contract" or "N.I.C.": equipment, furnishings, or other materials not included as a part of this Contract.

L. "Product": materials, systems and equipment.

1.04 REFERENCE STANDARDS

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by DATE OF ISSUE for Contract Documents, current on the effective date of the Owner-Contractor Agreement.

C. Should specified reference standards conflict with Contract Documents, the Contractor shall request clarification from Architect before proceeding.

D. The contractual relationship to the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

E. Schedule of References

1. Listed below are abbreviations for the names and titles of trade association names, federal government agencies and similar organizations which are referenced in the individual specification sections. The addresses and URL's (Uniform Resource Locators) provided are for the Contractor's convenience and are believed to be current and accurate, however addresses and URL's frequently change, and no assurance is made on their accuracy:

| | |
|---|---|
| AA | Aluminum Association<br>900 19th Street N.W., Suite 300 Washington, DC 20006<br>www.aluminum.com |
| ABAA | Air Barrier Association of America<br>1600 Boston-Providence Highway Walpole, MA 02081<br>www.airbarrier.org |
| AAMA | American Architectural Manufacturer's Association<br>1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268<br>www.aamanet.org |
| ACI | American Concrete Institute, International<br>38800 Country Club Drive, Farmington Hills, Michigan 48331<br>www.aci-int.org |
| ACPA | American Concrete Pipe Association<br>222 West Las Colinas Boulevard, Suite 641, Irving TX<br>www.concrete-pipe.org |
| ADC | Air Diffusion Council<br>104 S. Michigan Ave, Suite 1500, Chicago, IL 60603<br>www.flexibleduct.org |

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|---|---|
| AFPA | American Forest & Paper Association<br>(Formerly NFPA National Forest Products Association)<br>1111 19th St. N.W., Suite 800, Washington, DC 20036<br>www.afandpa.org |
| AGA | American Gas Association Inc.<br>1515 Wilson Blvd. Arlington, VA 22209-2469<br>www.agagas.com |
| AGAI | American Galvanizers Association Inc.<br>12200 E.Lliff Ave, Suite 204, Aurora, CO 80014-1252<br>www.galvanizeit.org |
| AIA | American Institute of Architects<br>1735 New York Avenue, N.W., Washington, DC 20006-5292<br>www.aia.org |
| AIHA | American Industrial Hygiene Association<br>2700 Prosperity Ave, Suite 250, Fairfax VA 22031<br>www.aiha.org |
| AISC | American Institute of Steel Construction<br>1 E. Wacher Dr., Suite 3100, Chicago,IL 60601-2001<br>www.aisc.org |
| AMCA | Air Movement and Control Association<br>30 W. University Drive, Arlington Heights, IL 60004-1893<br>www.amca.org |
| ANSI | American National Standards Institute<br>11 W. 42nd Street, 13 Floor, New York, NY 10036<br>www.ansi.org |
| APA | APA - The Engineered Wood Association<br>(formerly APA - American Plywood Association)<br>P.O. Box 11700, Tacoma, WA 98411-0070<br>www.apawood.org |
| ARI | Air-Conditioning and Refrigeration Institute<br>4301 N. Fairfax Dr., Suite 425, Arlington, VA 22203<br>www.ari.org |
| ASCA | Architectural Spray Coaters Association<br>230 West Wells Street, Suite 311, Milwaukee WI 53203<br>www.aecinfo.com |
| ASHRAE | American Society of Heating, Refrigerating, and Air-Conditioning Engineers<br>1791 Tullie Circle NE, Atlanta GA.30329<br>www.ashrae.org |
| ASME | American Society of Mechanical Engineers<br>345 East 47th Street, New York, NY 10017-2392<br>www.asme.org |
| ASTM | American Society for Testing and Materials<br>100 Barr Harbor Drive, West Conshohocken, PA 19428<br>www.astm,.org |
| AWPA | American Wood Preservers' Association<br>P.O. Box 286, Woodstock, MD 21163-0286<br>www.awpa.com |
| AWPI | American Wood Preservers' Institution<br>1945 Old Gallows Rd., Suite 150, Vienna, VA 22182<br>www.oas.org |
| AWS | American Welding Society<br>550 LeJeune Road, N.W., Miami, FL 33126<br>www.aws.org |

| | |
|---|---|
| BHMA | Builders Hardware Manufacturers Association, Inc.<br>355 Lexington Ave., 17 Floor New York, NY 10017<br>www.buildershardware.com |
| BIA | Brick Industry Association<br>11490 Commerce Park Drive, Reston, VA 22091-1525<br>www.bia.org |
| CISCA | Ceilings & Interior Systems Construction Association<br>579 W. North Ave., Suite 301, Elmhurst, IL 60126<br>www.cisca.org |
| CRI | Carpet and Rug Institute<br>310 Holiday Ave, Dalton, GA 30720<br>ww.carpet-rug.com |
| CRSI | Concrete Reinforcing Steel Institute<br>933 N. Plum Grove Road, Schaumburg, IL 60173-4758<br>www.crsi.org |
| CTIOA | Ceramic Tile Institute of America<br>12061 W.Jefferson BLVD, Culver City, CA 90230-6219<br>www.ctioa.org |
| DHI | Door and Hardware Institute<br>14170 Newbrook Dr., Chantilly, VA 22021-2223<br>www.dhi.org |
| FM | Factory Mutual Engineering & Research Corp.<br>1151 Boston-Providence Turnpike<br>Norwood, MA 02062<br>www.fmglobal.com |
| GA | Gypsum Association<br>6525 Belcrest Road, Suite 480, Hyattsville, MD 20782<br>www.gypsum.org |
| GANA | Glass Association of North America<br>2945 S.W. Wanamaker Dr., Suite A, Topeka, KS 66612-5321<br>www.glass.org |
| GICC | Glazing Industry Code Committee<br>3310 Harrison St., Topeka, KS 66611-2279<br>www.glazingcodes.net |
| IGCC | Insulating Glass Certification Council<br>3933 US Route 11, PO Box 2040, Cortland, NY 13045<br>www.igcc.org |
| KCMA | Kitchen Cabinet Manufacturers Association<br>1899 Preston White Drive, Reston VA 20191<br>www.kcma.org |
| LSGA | Laminators Safety Glass Association<br>3310 Harrison Street, Topeka KS 66611-2279<br>www.glass.org |
| MCAA | Mason Contractors Association of America<br>1910 S. Highland Ave. Suite 101, Lombard, IL 60148<br>www.masoncontractors.org |
| MIL | Military Specifications and Standards<br>Naval Publications and Forms Center<br>5801 Tabor Avenue, Philadelphia, PA 19120<br>www.milspec.com |
| NAAMM | National Association of Architectural Metal Manufacturers<br>8 South Michigan Avenue, Suite 1000, Chicago, IL 60603<br>www.naamm.org |

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|---|---|
| NCMA | National Concrete Masonry Association<br>2302 Horse Pen Road, Herndon, VA 20171-3499<br>www.ncma.org |
| NEBB | National Environmental Balancing Bureau<br>8575 Government Circle, Gaithersburg, MD 20877-4121<br>www.nebb.org |
| NEMA | National Electrical Manufacturers' Association<br>1300 N. 17th St., Suite 1846, Rosslyn, VA 22209<br>www.nema.org |
| NFPA | National Fire Protection Association<br>1 Battery March Park, PO Box 9101, Quincy, MA 02269<br>www.nfpa.org |
| NFRC | National Fenestration Rating Council<br>6305 Ivy Lane, Greenbelt MD 20770<br>www.nfrc.org |
| NRCA | National Roofing Contractors Association<br>10255 W. Higgins Road, Suite 600, Rosemont, IL 60018-5607<br>www.nrca.net |
| PCA | Portland Cement Association<br>5420 Old Orchard Road, Skokie, IL 60077-1083<br>www.cement.org |
| PEI | Porcelain Enamel Institute<br>4004 Hillsboro Pike, Suite 224B, Nashville, TN 37215<br>www.porcelainenamel.com |
| PS | Product Standard<br>U. S. Department of Commerce<br>www.omg.org |
| SDI | Steel Deck Institute<br>P.O. Box 25, Fox River Grove, IL 60021-0025<br>www.sdi.org |
| SEI | Structural Engineering Institute<br>of the American Society of Civil Engineers<br>1801 Alexander Bell Drive<br>Reston VA 20191<br>www.seinstitute.org |
| SGCC | Safety Glass Certification Council<br>RMS, P.O. Box 9 Henderson Harbor, NY 13651<br>www.sgcc.org |
| SIGMA | Sealed Insulating Glass Manufacturers Association<br>401 N. Michigan Ave., Suite 2400, Chicago, IL 60611<br>www.glasschange.com |
| SJI | Steel Joist Institute<br>3127 10th Ave. N., Myrtle Beach, SC 29577<br>www.steeljoist.org |
| SMACNA | Sheet Metal and Air Conditioning Contractors' National Association<br>4201 Lafayette Center Dr., Chantilly, VA 22022-1209<br>www.smacnapa.org |
| SPIB | Southern Pine Inspection Bureau<br>4709 Scenic Highway, Pensacola, FL 32504-9094<br>www.spib.org |
| SSMA | Steel Stud Manufacturer's Association<br>8 South Michigan Avenue, Chicago IL 60603<br>www.ssma.com |

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|---|---|
| SSPC | The Society for Protective Coatings<br>40 24th Street, 6th Floor, Pittsburgh PA 15222-4623<br>www.sspc.org |
| SWRI | Sealant, Waterproofing & Restoration Institute<br>2841 Main Street, Suite 585, Kansas City, MO 64108<br>www.swrionline.org |
| TCNA | Tile Council of North America, Inc.<br>100 Clemson Research Blvd., Anderson, SC 29625<br>www.tileusa.com<br>*(formerly TCA, Tile Council of America)* |
| TMS | The Masonry Society<br>3970 Broadway, Suite 201D, Boulder CO 80304<br>www.masonrysociety.org |
| UL | Underwriters' Laboratories, Inc.<br>333 Pfingston Road, Northbrook, IL 60602<br>www.ul.com |
| WDMA | Window & Door Manufacturers Association<br>(formerly National Wood Window & Door Association, NWWDA)<br>205 E. Touhy Avenue, Suite G-54, Des Plaines, IL 60018<br>www.nwwda.org |

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

END OF SECTION

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# SECTION 01 43 39
# MOCKUPS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Mockup requirements.

1. Mockup assemblies are required for, but not limited to the following:
   a. Onsite exterior wall section sample panel.
2. Additional field samples and mockups specified in individual Specification Sections.

B. All Mockups specified herein, under other Sections of the Specifications, and shown on drawings will be reviewed and approved by the Engineer and Owner. Unaccepted Mockups shall be replaced or reconstructed in part or in total and the extent of the replacement or reconstruction shall be at the discretion of the Engineer and Owner. The Contractor shall carry forth mockup replacement or reconstruction until Engineer's acceptance is obtained. Mockup costs, including as many replacements or reconstruction as necessary to gain Engineer's acceptance, shall be included in the Contract Cost and Schedule.

### 1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

B. Section 04 20 00 - UNIT MASONRY.

C. Section 05 40 00 - COLD-FORMED METAL FRAMING.

D. Section 05 50 00 – METAL FABRICATIONS.

E. Section 06 10 00 - ROUGH CARPENTRY.

F. Section 06 16 00 - SHEATHING.

G. Section 07 21 00 - THERMAL INSULATION.

H. Section 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS.

I. Section 07 42 43 – COMPOSITE WALL PANELS.

J. Section 07 62 00 - SHEET METAL FLASHING AND TRIM.

K. Section 07 92 00 - JOINT SEALERS.

L. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS.

M. Section 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES.

N. Section 13 42 00 – PRE-ENGINEERED METAL BUILDINGS.

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Submit shop drawing of mockup indicating sizes, finishes, method of construction and installation of each component.

1.04 GENERAL

A. Scheduling: All specified Mockups are required to be fabricated, reviewed and accepted prior to ordering of materials for the project, and prior to construction of building elements which the Mockups demonstrate.

B. Where requested by Engineer, or as specified in individual specification sections, assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals, and finishes. Remove Mockup assemblies prior to date of Final Inspection, or as directed.

C. Mockups, when approved by the Engineer, will be used as datum for comparison with the remainder of the Work for the purposes of acceptance or rejection. Maintain Mockup throughout construction period until Substantial Completion or as otherwise directed by Engineer.

1. Approval of Mockups and field samples do not constitute approval of any deviations from the Contract Documents.

2. Finishes, colors and textures of components shall be as specified for each component and shall be selected by the Engineer.

D. Demolish and remove from site prior to requesting inspection for certification of Substantial Completion, all Mockups which are not permitted to remain as part of the finished work.

1.05 COORDINATION

A. Coordinate work of trades and schedule elements to expedite the fabricating, furnishing, and installation of multiple component Mockups specified herein, in other Sections of the Specifications, and as shown in the Contract Documents.

## PART 2 - PRODUCTS

2.01 EXTERIOR WALL SECTION MOCKUP

A. Mockup Unit: Shall consist of one full size facsimile exterior wall section, using specified products as noted below. Mock-up shall be a minimum 12 feet high by 6 feet wide.

1. General description: Mockup unit shall include exterior masonry construction, with structural steel, light gage steel stud framing backup and sheathing assembly as well as concrete backup. Mockup shall include all components specified and indicated which are typical to the exterior wall construction and additional components specified herein.
    a. Fabricate mockup unit with ground face masonry as specified, with selected mortar and backup consisting of 8 inch metal studs, exterior sheathing board on outside face of studs and masonry backup both with specified brick anchors.
        1) Provide additional metal stud framing and cross-bracing required for construction of various components of the mockup panel.
        2) Provide concealed various wood blocking, edgings, nailers, curbs, and cants required for receipt of various finishes and surfacing materials.
    b. Fabricate aluminum storefront unit with glazing.
    c. Include into mockup assembly all flashing, joint sealers, and all finish trim and accessories necessary to show typical completed construction.
2. Finishes, colors and textures of components shall be as specified for each component and shall be selected by the Engineer.
    a. Provide window unit with specified insulated glazing.

B. Components to be included in the mockup include, but are not limited to:
1. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
    a. Provide a concrete foundation wall to a depth required to support wall mockup.
2. Section 04 20 00 - UNIT MASONRY.
    a. Provide type of concrete masonry units and colored mortar specified, installed over cast in place concrete and cold formed metal framing and gypsum sheathing with specified anchorage devices.
    b. Provide bond pattern, mortar color, and joint type to be used in the Work.
    c. Provide rigid insulation over masonry backup.
3. Section 05 40 00 - COLD-FORMED METAL FRAMING:
    a. Provide cold formed metal stud framing with bracing for construction and support of the mockup panel.
4. Section 05 50 00 – METAL FABRICATIONS.
    a. Provide galvanized steel lintels as needed for openings in the mockup panel.
5. Section 06 10 00 – ROUGH CARPENTRY:
    a. Provide wood blocking at typical locations as part of mockup.
6. Section 06 16 00 - SHEATHING:
    a. Install sheathing board with taped joints and metal and membrane flashing.

b. Provide rigid insulation over sheathing and masonry backup.

7. Section 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS:
   a. Provide air barrier over sheathing and masonry backup including typical flashing conditions and transitional tie-ins to storefront.
8. Section 07 42 43 – COMPOSITE WALL PANELS:
   a. Provide typical composite panel elements as part of mock up panel showing interface with adjacent materials.
9. Section 07 62 00 - SHEET METAL FLASHING AND TRIM:
   a. Provide typical metal flashing built into masonry construction.
10. Section 07 92 00 - JOINT SEALERS:
    a. Provide joint sealant at perimeter of all components. Colors shall be selected by the Engineer.
11. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS: Provide fixed glass type storefront assembly and door matching indicated profiles and dimensions exactly.
    a. Storefront framing to be enamel shop finished to match selected PVDF finish matching color and sheen.
12. Section 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES: Provide fixed translucent panel assembly matching indicated profiles and dimensions exactly.
    a. Trim shall be shop finished to match approved finish.
13. Section 13 42 00 – PRE-ENGINEERED METAL BUILDINGS: Structural steel framing. Preparation of openings in metal building system to receive work of the Section. Metal wall panels and roof system as part of mockup assembly.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Construct Mockups at locations indicated or, if not indicated, at locations directed by the Engineer.

B. Construct Mockup in time to make product and/or assembly modifications without delaying production work.

### 3.02 INSTALLATION

A. Construct Mockup to duplicate actual job conditions.
   1. Locate at an area on site as directed by the Engineer.

2. Provide foundations, bases, supports and braces adequate to make Mockup stable and safe.

B. Provide weather protection for materials in Mockups that are not exposed to weather in intended service.

3.03 REMOVAL

A. Retain Mockups during construction as a standard for judging completed work until time designated by the Engineer and the Owner,

1. Completely demolish and remove Mockups from the job site at time designated by Engineer.
2. Accepted Mockups (which are specifically identified and accepted by the Engineer to become part of the work) may be incorporated into the work provided they are not damaged during subsequent construction.

END OF SECTION

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# SECTION 01 45 00
# QUALITY CONTROL

## PART 1 - GENERAL

1.1 SUMMARY

A. General quality assurance and control of installation.

B. Site safety, worker safety and training.

C. Contractor's quality control (QC) program.

D. Source quality control.

E. Field samples and mock-ups.

F. Manufacturer's field services and reports.

G. Field quality control, Owner's right for confirmation.

1.2 RELATED REQUIREMENTS

A. Section 01 43 39 - MOCK-UPS.

B. Section 01 45 29 - TESTING LABORATORY SERVICES.

1.3 GENERAL QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including performance of each step in sequence. Notify Architect when manufacturers' instructions conflict with the provisions and requirements of the Contract Documents; obtain clarification before proceeding with the work affected by the conflict.

C. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate high standards or more precise workmanship.

D. Perform work by persons qualified to produce workmanship of specified quality.

E. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

## 1.4 SITE SAFETY, WORKER SAFETY AND TRAINING

A. General: The Contractor (and his subcontractors) shall, at all times, exercise reasonable precautions for the safety of all persons. All rules, regulations, and laws concerning safety that are in effect at the work site, and in particular, all applicable regulations of the Occupational Safety and Health Administration (OSHA) of the U.S. Government, in addition to specified requirements shall be complied with in all respects.

1. Contractor's responsibility for safety shall apply continuously twenty four (24) hours per day during the term of this Contract and is not limited to normal or extended working hours.

B. Contractor’s safety program: Prior to commencement of the Work, the Contractor shall develop and implement a Safety and Health Plan to comply with the Occupational Safety and Health Administration (OSHA) standards for the Construction Industry and all other applicable Federal, State, local laws and regulations. Contractors Safety and Health Plan, and included health and safety procedures and policies, shall be submitted to the Architect and Owner’s Representative within fifteen (15) Days after the date of Notice to Proceed and in no event later than commencement of the Work, whichever occurs first.

1. Perform pre planning to ensure access Is provided to Fire Department for all areas of the work site throughout the duration of the Contract. The Contractor shall provide the Fire Department site access maps, updated regularly, to reflect changes in the layout of the work site and shall notify the Fire Department when each update is made
2. Post and maintain, at prominent locations throughout the Project site, emergency telephone numbers and shall insure that all personnel on site are continuously aware of this information.
3. Ensure safe access to the Work for the Owner, Architect, Architect’s consultants, their designated representatives, and all others charged with inspection, testing and monitoring of the Work, and visitors to the site. The Contractor shall furnish site visitors with safety equipment, test equipment, safety apparel and instructions that are required to ensure their safety on site, and in the performance of their duties related to the Work of this Contract

C. All employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration (OSHA) that is at least 10 hours in duration. The OSHA training and certification course shall occur at the time each employee begins work. Furnish documentation to Owner and Architect, for each employee documenting successful completion of the OSHA safety training and certification course. Submit with the first certified payroll report.

## 1.5 CONTRACTOR'S QUALITY CONTROL PROGRAM

A. Procedures: Contractor and each subcontractor shall include all labor, materials, equipment, services and incidental items necessary to implement quality control procedures to the extent necessary to demonstrate and maintain compliance with the Contract Documents.

B. Quality Control Plan: Within 20 days after Notice to Proceed, the Contractor shall submit a Quality Control (QC) Plan to the Owner's Representative and Architect for approval. The plan shall address the following, as a minimum:

1. The Contractor's commitment to quality and implementing and managing the QC program.
2. Identification of the Contractor's onsite QC Manager, with name, qualifications, duties and responsibilities. The QC Manager shall have the authority to direct the removal and replacement of non-conforming work. The QC Manager shall be present for all QC meetings, inspections and tests during the project.
3. Procedures for addressing and commenting QC with Contractor's staff, all subcontractors and suppliers, and Owner, Architect and Owner's representative.
4. Procedures for review of submittals and submittal status, and documentation of same.
5. Procedures for pre-installation meetings and documentation of same.
6. Procedures for inspections of deliveries and documentation of same.
7. Procedures for benchmark inspections, defined as initial installations, and documentation of same.
8. Procedures for mockup inspections and documentation of same.
9. Procedures for equipment in place, inspections and documentation of same.
10. Procedures for inspections prior to closures of concealment and documentation of same.
11. Procedures for start-up and commissioning and documentation of same.
12. Procedures for turnover and documentation of same.
13. Procedures for identifying, recording, tracking correcting and reporting items requiring rework, using a Rolling Completion list chronological item number, phase area, date listed, description, party responsible for correction, date notified, and date corrected.
14. Procedures for testing and documentation of same.
15. Procedures for corrective action on Architect's Field Reports and Testing Agency reports and documentation of same.

C. Procedures for reporting on all of the above on a monthly basis as a condition precedent to review of the Contractor's application for payment.

1.6 SOURCE QUALITY CONTROL

A. 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.

B. 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.

C. Product Labeling: Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code(s).

1. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.

a. Model number.

b. Serial number.

c. Performance characteristics.

1.7 FIELD SAMPLES

A. Install field samples demonstrating quality level for the Work, at the site as required by individual specifications Sections for review and acceptance by Architect. Remove field samples prior to date of Final Inspection, or as directed.

1.8 MOCK-UPS

A. Comply with requirements of Section 01 43 39 - MOCK-UPS.

1.9 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When called for by individual Specification Sections, provide at no additional cost to the Owner, manufacturers' or product suppliers' qualified staff personnel, to observe site conditions, start-up of equipment, adjusting and balancing of equipment, conditions of surfaces and installation, quality of workmanship, and as specified under the various Sections.

1. Individuals shall report all observations, site decisions, and instructions given to applicators or installers. Immediately notify Architect of any circumstances which are supplemental, or contrary to, manufacturer's written instructions.

2. Submit full report within 30 calendar days from observed site conditions to Architect for review.

1.10 FIELD QUALITY CONTROL

A. The Owner reserves the right to take samples and perform, at random, tests of approved materials delivered to the job site to verify compliance of actual materials with specifications.

**PART 2 - PRODUCTS** (Not Used)

**PART 3 - EXECUTION** (Not Used)

END OF SECTION

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SECTION 01 45 23

TESTING AND INSPECTION

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Special Inspections and Structural Testing Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents and Chapter 17 *of the Building Code of New York State* (BCNYS) including, but not limited to the following:

1. Steel Construction – BCNYS Section 1704.3 & Table 1704.3
2. Concrete Construction – BCNYS Section 1704.4 & Table 1704.4
3. Masonry Construction – BCNYS Section 1704.5 & Tables 1704.5.1, 1704.5.3
4. Soils – BCNYS Section 1704.7

B. Hold a Special Inspections Preconstruction Meeting at least 7 days prior to the initial planned date for start of construction.

1. Discussions shall include the following:
   a. Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.
   b. Responsibilities of Contractor, Owner, Testing Agency, Special Inspector and Registered Design Professional.
   c. Notification and reporting procedures.
2. Attendees shall include the Contractor, Owner's Representative, Testing Agency, Special Inspector and Registered Design Professionals for Structural Engineering and for Architecture.

### 1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the testing and inspection requirements as specified herein.

### 1.3 RELATED SECTIONS

A. Requirements for testing and inspection shall be described in various Sections of these Specifications. Where no testing and inspection requirements are described but the Owner determines that it is necessary, the Owner may request additional testing and inspection to be performed at his own expense.

B. Work Not Included

1. Unless otherwise noted in this Section or other Section of work, the Owner will select a pre-qualified independent testing laboratory and inspection professional.

2. Unless otherwise noted in this Section or other Sections of work, the Owner will pay for all initial services of the testing laboratory and inspection professionals as further described in Article 2.1 of this Section of these Specifications.

1.4 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329-95 "Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."

B. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

1.5 PRODUCT HANDLING

A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

**PART 2 PRODUCTS**

2.1 PAYMENTS FOR TESTING AND INSPECTION SERVICES

A. Initial Services: The Owner will pay for all initial testing and inspection services.

B. Retesting and Cancelled Tests and Inspections: When initial tests and inspections indicate non-compliance with local Codes and the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing laboratory and inspectors and the costs thereof will be deducted by the Owner from the Contract Sum.

2.2 CODE COMPLIANCE TESTING AND INSPECTION

A. Inspections and tests required by Codes or Ordinances, or by a plan approval authority, shall be paid by for by the Owner unless otherwise noted in this Section or other Sections of work. Retesting or inspection as required shall conform to the requirements of Article 2.1 B of this Section.

1. Required Building Department Inspections:
   a. Excavation and Footing Forms
   b. Foundation Walls
   c. Slab Inspection
   d. Framing
   e. Plumbing Underground
   f. Plumbing – Waste & Vents
   g. Plumbing – Gas
   h. Electrical – Wiring and Final
   i. HVAC
   j. Insulation
   k. Final

2. For all above inspections, the Inspector must be accompanied by the Contractor whose work is being inspected.

2.3 CONTRACTOR'S TESTING

A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

B. Where operating tests are specified, the Contractor shall test his work as it progresses, on his own account, and shall make satisfactory preliminary tests in all cases before applying for official tests.

C. Tests shall be made in the manner specified, for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently, the Contractor shall do so without extra compensation. The Contractor shall furnish all labor, material and apparatus, make corrections and conduct the official test. The test will be conducted in the presence of a representative of the Architect.

D. All parts of the mechanical and electrical work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition. All defects disclosed by these tests shall be corrected to the satisfaction of the Architect and Engineer without any additional cost to the Owner. Tests shall be repeated on this repaired or replaced work if deemed necessary by the Architect. The Architect shall be notified at least forty-eight (48) hours in advance of all tests, and shall be represented at tests that he deems necessary. The Contractor shall furnish all necessary instruments, other equipment, and personnel required for such tests.

E. Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Architect.

F. If the Architect or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, he will endeavor to do so promptly and, where practicable, at the source of supply.

**PART 3 EXECUTION**

3.1 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

A. Representatives of the testing laboratory and inspectors shall have access to the work at all times. Provide facilities for such access in order that they may properly perform their functions.

B. The Contractor shall cooperate with the Special Inspector and his agents so that Special Inspections and testing may be performed without hindrance.

C. The Contractor shall notify the Special Inspector and/or Testing/Inspecting Agency at least 48 hours in advance of a required inspection or test.

D. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source or products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

E. If Special Inspections or testing require the use of the Contractor's scaffolding to access work areas, the Contractor shall provide a competent person to perform the daily evaluation of the

scaffolding to verify that it is safe to use. The Contractor shall notify the Special Inspector and Testing Agent of this review before each use. The Contractor is responsible for the safe assembly and stability of the scaffolding.

F. The Contractor shall keep the latest set of Construction Drawings, field sketches, accepted shop drawings and specifications at the project site for field use by the Inspectors and Testing Technicians.

G. The Contractor shall perform remedial work (if required) and sign non-conformance reports stating that remedial work has been completed. The Contractor shall submit signed reports to the Special Inspector as work proceeds.

H. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.

I. The Contractor shall be solely responsible for construction site safety.

3.2 SCHEDULES

A. Establishing Schedule: By advance discussions with the inspection service and testing laboratory selected by the Owner, determine the time required to perform inspections and tests and to issue each of its findings. Provide all required time within the construction schedule.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the inspectors and testing laboratory as required.

C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay will be back-charged to the Contractor.

3.3 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION 01 45 23

# SECTION 01 45 29
# TESTING LABORATORY SERVICES

## PART 1 - GENERAL

### 1.01 SUMMARY

A. This Section consists of the following:
   1. Quality assurance.
   2. Laboratory responsibilities.
   3. Laboratory reports.
   4. Limits on testing laboratory authority.
   5. Contractor responsibilities.
   6. Contractor submittals.
   7. Schedule of inspections and tests.

### 1.02 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
   2. AAMA 502 -Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
   3. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
   4. 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.
   5. ANSI/ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

### 1.03 QUALITY ASSURANCE

A. Comply with requirements of ANSI/ASTM D 3740 and ANSI/ASTM E 329.

B. Laboratory: Authorized to operate in state in which Project is located.

C. Laboratory staff: Maintain a full-time specialist on staff to review services.

D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards (NBS) Standards or accepted values of natural physical constraints.

## 1.04 LABORATORY RESPONSIBILITIES

A. Cooperate with Engineer and Contractor in performance of services; provide qualified personnel promptly on notice.

1. Attend preconstruction conferences and progress meetings, as requested.

B. Acquaint Owner’s Project Representative, Engineer, and Contractor's superintendent with testing procedures and with all special conditions encountered at the site.

C. Perform specified inspection, and testing of products and construction methods in accordance with specified standards as specified in individual technical specification sections:

1. Comply with specified standards, ASTM, ANSI, and other recognized authorities.
2. Conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviations therefrom.
3. Obtain Contractor's written acknowledgment of each inspection, sampling, and test made. Test samples of mixes submitted by Contractor.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.

D. Promptly notify Engineer and Contractor of irregularities, deficiencies, or non-conformance of Work or Products which are observed during performance of services.

E. Promptly submit written report of each test and inspection; one copy each to Engineer, Owner, Contractor, and one copy to Project Record Documents File.

F. Perform additional inspections and tests required by Engineer.

## 1.05 LABORATORY REPORTS

A. After each test, promptly distribute directly from the testing laboratory, copies of laboratory report to:

1. Owner’s Project Representative.
2. Engineer's office.
3. Contractor's office.
4. Municipal Inspectional Services Department, if required.

B. Include in report the following information:

1. Date issued,
2. Project title and number,
3. Testing laboratory name, address, and telephone number.

4. Name and signature of laboratory inspector.
5. Date and time of sampling,
6. Record of temperature and weather conditions (as appropriate to test).
7. Identification of product and Specifications Section,
8. Location of sample or test in the Project.
9. Type of inspection or test.
10. Results of tests and compliance with Contract Documents.
11. Interpretation of test results, when requested by Engineer.
12. Observations regarding compliance with Contract Documents

1.06 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of Work.

C. Laboratory may not assume any duties for Contractor.

D. Laboratory has no authority to stop the Work.

1.07 CONTRACTOR RESPONSIBILITIES

A. Coordinate and cooperate with laboratory personnel, provide access to Work, and to manufacturer's facilities.

1. Monitor each inspection, sampling, and test.
2. Provide Laboratory or Agency with written acknowledgment of each Inspection, sampling, and test.
3. Within 24 hours notify Engineer and Owner in writing of reasons for not acknowledging Laboratory results.

B. Secure and deliver to the Laboratory or designated location, adequate quantities of representational samples of materials proposed to be used and which require testing, along with proposed mix designs.

C. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.
2. To obtain and handle samples at the Project site or at the source of the Product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

D. Furnish verification of materials and equipment compliance with Contract Documents.

E. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

F. Identify materials to be tested or inspected by Testing Laboratory or Agency.

G. After determination of need for testing or inspecting by Owner, notify Laboratory sufficiently in advance, a minimum of five days of operations to allow for its assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

H. Make arrangements with laboratory and pay for additional samples and tests required for the following conditions:

1. Initial testing indicates Work does not comply with Contract Documents.
2. Contractor requested testing for additional testing and laboratory services beyond specified requirements.

## 1.08 CONDUCT OF INSPECTIONS AND TESTS

A. The General Contractor shall notify the Owner, Engineer, and Testing Laboratory a minimum of 72 hours before the performance of work to permit the proper conduct of Owner-authorized inspections and tests.

B. Representatives of Testing Laboratory will inspect the manufacture, assembly, and placement of materials as required and as authorized by the Owner, and report their findings to the Engineer, Owner, and Contractor.

C. Work shall be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection when such defect is discovered, nor shall it obligate the Owner to accept such work.

## 1.09 SCHEDULE OF TESTING AND LABORATORIES

A. Except as otherwise specified, Contractor will appoint, employ, and pay services of independent firm(s) to perform inspection and testing and other services specified herein, in individual specification Sections, and as additionally required by the Engineer.

B. Requirements for testing, observations, and inspections are described in individual specification sections; the schedule provided below is not intended to completely describe all of the inspection and testing Work required for this Contract, and is only furnished as a guide.

1. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS: In-place testing of specified limits of air infiltration and water resistance according to AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

C. Special Tests and Inspections: Contractor will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

1. Testing agency will notify Engineer, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Engineer, through General Contractor, with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and re-inspect corrected work.

D. Local Authority Inspections: The Contractor is also responsible for coordinating and cooperating with local requirements for inspections by local Authorities.

1.10 SCHEDULE OF TESTING

A. Testing of aluminum framed storefront:

1. Testing shall be performed and paid for by the General Contractor and witnessed by the Owner’s Project Representative, Engineer and Glass and Glazing Subcontractor.
2. Testing of installed work subject to the following requirements:
   a. Independent inspection and testing agency engaged on the project shall be authorized by authorities having jurisdiction to operate in the State of New York and as acceptable to the Owner and Engineer.
   b. Testing agency will notify Owner’s Project Representative, Engineer and Glass and Glazing Subcontractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   c. Testing agency will submit a certified written report of each test, inspection, and similar quality control service to Engineer with copy to Owner’s Project Representative, Engineer and Glass and Glazing Subcontractor.
   d. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   e. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   f. Testing agency will retest and re-inspect corrected work.
3. In-place testing of specified limits of air infiltration and water resistance according to following:

a. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.

b. AAMA 502 -Voluntary Specification for Field Testing of Newly Installed Fenestration Products.

c. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

d. 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.

e. Failed tests will result in additional testing of the failed specimens and an additional specimen at the cost of the Contractor. Testing will be concluded only when satisfactory results are achieved. Any required re-testing that is a result of deficient installation shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

4. Schedule of testing:

a. Nominal 10’-0” wide storefront assembly; quantity = 1

1.11 FOLLOW-UP AND CORRECTIVE ACTION

A. The Contractor and the Owner will note the test record on the Testing Log to acknowledge test procedures and results. If follow-up or corrective action is needed, the Contractor shall submit to the Owner two written copies of proposed follow-up or corrective plans and obtain the Owner's written approval before proceeding.

1. Cost of Testing: If tests indicate that materials or work do not comply with requirements, the Contractor shall pay for all retesting, and shall remove and replace non-complying work at no additional cost to the Owner.

**PART 2 - PRODUCTS** (Not Used)

**PART 3 – EXECUTION** (Not Used)

END OF SECTION

# SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

## 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.

### 1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:

1. Division 1 Section “Summary” for limitations on utility interruptions and other work restrictions.
2. Division 1 Section “Summary of Multiple Contracts” for division of responsibilities for temporary facilities and controls.
3. Division 1 Section “Submittal Procedures” for procedures for submitting copies of implementation and termination schedule and utility reports.
4. Division 1 Section “Execution Requirements” for progress cleaning requirements.
5. Divisions 2 through 33 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
6. Division 31 Section “Dewatering” for disposal of ground water at Project site.
7. Division 32 Section “Asphalt Paving” for temporary roads and paved areas.

### 1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

### 1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner’s construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Electric Power Service: Use charges are specified in Division 1 Section “Summary of Multiple Contracts.”

### 1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

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 pavement Sections.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

C. Portable Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

D. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."

E. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-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 9 painting Sections.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Construction Manager Field Office: Provide a separate insulated, weather-tight, heated and air-conditioned field office for use by only Construction Management personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 20 persons at Project site. Construction Manager Field office to be maintained for the **DURATION** of the project.

1. Furnish and equip each office as follows:

   a. Provide two rooms each furnished with one desk and three chairs, four-drawer file cabinet, a plan table, a plan rack, 4-foot-square tack board and bookcase.
   b. Provide one room of not less than 240 sq. ft. for Project meetings. Furnish room with conference table, 20 folding chairs, 3-foot by 4-foot white marker board, and 4-foot-square tack board.
   c. Water cooler and private toilet complete with water closet, lavatory, and medicine cabinet with mirror.
   d. Provide one 3.6 cu. ft. refrigerator.
   e. Provide one microwave.
   f. Provide one first aid kit: Johnson and Johnson Co., Model No. 25 or equal.
   g. Provide one EcoTank Pro ET-5150 Wireless All-in-One Supertank Printer:
      1) Provide ink and supplies for the project duration
   h. Provide 20-reams (5,000 sheets) of 8-1/2-inch by 11-inch, 24-pound laser paper
   i. Provide one personal computer from the following options, including all required cables, with the following attributes:
      1) DELL or HP Business Classic PC
      2) 8th Generation Intel Core i700-8700 Processor
      3) Windows 10 Pro 64-bit English
      4) MS Office 2016 Professional
      5) 24” LCD monitor
      6) 6GB, DDR4, 2666MHz
      7) 3.5 inch 1TB 7200rpm SATA Hard Drive
      8) Wireless and Ethernet Networking

   j. SSD External Hard Drive 2TB

   k. Provide security bars at doors and security screens at all windows.

   l. Provide stairs at each door.

2. Provide heater with thermostat capable of maintaining a uniform indoor temperature of 68 deg F.
3. Provide fluorescent light fixtures capable of maintaining average illumination of 25 fc at desk height. Provide 110- to 120-V duplex outlets spaced at not more than 12-foot intervals, 1 per wall in each room.
4. Provide one large and two small trash cans with bags for project duration.
5. Janitorial Services: Provide janitorial services on a weekly basis for temporary Construction Manager field office.
6. The contents of the Field Office shall become the property of the Owner upon Substantial Completion of the Contract.

C. 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: 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, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

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 and to limit site disturbance.

B. Provide each facility ready for use when needed to avoid delay. Do not remove without approval of Construction Manager, and until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 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. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

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.
2. Hose-Bib, Backflow-Prevention Devices: ASSE standard, nonremovable-type, backflow-prevention devices with ASME B1.20.7, garden-hose threads on outlet.
3. Water service piping to be copper tube or polyvinyl chloride (PVC) plastic pipe.
4. Provide one hose bib at point where temporary service connects to existing or new water service, after back-flow protection.
5. Provide one hose bib on each story of structure at earliest time possible in vicinity of Stair 1.
6. Provide protective enclosure if temporary service connects to new or existing service outside the building, complying with the following:

a. Freeze-Protection Enclosures: Insulated and with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.

1) Housing: Reinforced-aluminum or -fiberglass construction.
2) Drain opening for units with drain connection.
3) Access doors with locking devices.
4) Insulation inside housing.
5) Anchoring devices for attaching housing to concrete base.
6) Electric heating cable or heater with self-limiting temperature control.
7) Precast concrete base of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.
8) Electrical Contract shall provide power to enclosure as indicated.
9) Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

7. Provide back-flow protection at point where service connects to new or existing service, complying with the following:

a. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

C. Sanitary Facilities: 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.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: 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.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead, unless otherwise indicated.
2. Install main temporary electric panel at Staging Area per the Construction Implementation Plan (CIP-1) and a secondary temporary electric panel within 50 feet of the main temporary panel by the proposed building area (Exact location to be determined).

G. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
2. Provide warning signs at power outlets other than 110 to 120 V.
3. Provide 4-gang outlets, spaced so 75-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

H. Lighting: 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.
2. Install lighting for Project identification sign.
3. Provide one 100-W incandescent lamp every 20-feet in traffic areas.
4. Provide two 100-W incandescent lamps per story in stairways and ladder runs, located to illuminate each landing and flight.
5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.

I. Telephone Service: Provide temporary telephone service in each field office for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the common-use field office as follows:

   a. Provide a dedicated telephone line for facsimile machine and computer.
   b. Provide second voice line for general use.

2. At each telephone, post a list of important telephone numbers.

   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor’s home office.
   d. Architect’s office.
   e. Engineers’ offices.
   f. Owner’s office.
   g. Principal subcontractors’ field and home offices.

J. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in each facility.

1. Provide high speed internet line in CM field office.

3.3 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 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 Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earthwork."
3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Hot-Mix Asphalt Paving."

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. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. 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.

1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

G. 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 1 Section "Execution Requirements" for progress cleaning requirements.

H. Temporary Elevator Use: Refer to Division 14 Sections for temporary use of new elevators.

I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

J. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 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 work restrictions specified in Division 1 Section “Summary.”

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

F. 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. Refer to Construction Implementation Plan (CIP-1).

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 with two sets of keys.

G. 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.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. 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 or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

J. 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. Provide a Fire-Watch for work performed after hours.
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.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

## 3.5 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, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. 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. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. 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. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace 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 1 Section "Closeout Procedures."

END OF SECTION 015000

# SECTION 01 60 00- PRODUCT REQUIREMENTS

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

### 1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete product requirements as specified herein, including, but not limited to, the following:

1. Product delivery, storage and handling.
2. Storage and protection.
3. Identifying markings.
4. Substitution requirements.
5. Temporary use of equipment.
6. General standards.

### 1.3 RELATED SECTIONS

A. Execution Requirements - Section 017300.

### 1.4 TRANSPORTATION AND HANDLING

A. Materials, products, and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.

B. More detailed requirements for transportation and handling are specified under the technical Sections.

### 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site 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 installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.

2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

6. Protect stored products from damage and liquids from freezing.

7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 IDENTIFYING MARKINGS

A. Name plates and other identifying markings shall not be affixed on exposed surfaces of manufactured items installed in finished spaces.

1.7 PRODUCT APPROVAL STANDARDS

A. Where the words "or approved equal" or other synonymous terms are used, it is expressly understood that they shall mean that the approval of any such submission is vested in the Architect, whose decision shall be final and binding upon all concerned. All submissions are subject to such approval and shall conform to the requirements of Article 1.8 herein.

1.8 SUBSTITUTIONS

A. After the contract has been executed, the Architect will consider a formal request for the substitution of products in place of those specified, under the following conditions:

1. The request is accompanied by complete data on the proposed substitution substantiating compliance with the Contract Documents including product identification and description, performance and test date, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified or named by Addenda, with data relating to Contract time schedule, design and artistic effect where applicable, and its relationship to separate contracts.

2. The request is accompanied by accurate cost data on the proposed substitution in comparison with the product specified, whether or not modification of the Contract Sum is to be a consideration.

B. Requests for substitution based on Para (1) above, when forwarded by the Contractor to the Architect for review are understood to mean that the Contractor:

1. represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified:

2. will provide the same guarantee for the substitution that he would for that specified;

3. certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under separate contracts and the Architect's redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently become apparent; and

4. will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, at no additional cost to the Owner and at no extension of the contract completion date.

C. Substitutions will not be considered if:

1. they are indicated or implied on shop drawings submissions without the formal request required in Para (1) above; or

2. for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.

3. The Architect will examine, with reasonable promptness, such substitution submittals, and return of submittals to the Contractor shall not relieve the Contractor from responsibility for deviations and alternatives from the contract plans and specifications, nor shall it relieve him from responsibility for errors in the submittals. A failure by the Contractor to identify in his letter of transmittal material deviations from the plans and specifications shall void the submittals and any action taken thereon by the Architect. When specifically requested by the Architect, the Contractor shall resubmit such shop drawings, descriptive data and samples as may be required to evaluate substitutions.

D. If any mechanical, electrical, structural, or other changes are required for the proper installation and fit of alternative materials, articles, or equipment, or because of deviations from the contract plans and specifications, such changes shall not be made without the consent of the Architect and shall be made without additional cost to the Owner.

1.9 TEMPORARY USE OF EQUIPMENT

A. No equipment intended for permanent installation shall be operated for temporary purposes without the written permission of the Architect.

B. The temporary or trial usage by the Owner of any mechanical device, machinery, apparatus, equipment or any work or materials supplied under this Contract before final completion and written acceptance by the Architect, shall not be construed as evidence of the acceptance of same

by the Owner. The Owner shall have the privilege of such temporary and trial usage, for such reasonable length of time as and when the Architect shall deem to be proper for making a complete and thorough test of same and no claim for damage shall be made by the Contractor for the injury to or breaking of parts of such work which may be caused by weakness or inaccuracy of structural parts or by defective material or workmanship. If the Contractor so elects, he may at his own expense, place a competent person or persons to make such trial usage; such trial usage shall be under the supervision of the Contractor.

1.10 GENERAL REQUIREMENTS

A. In the event that it is necessary for the Contractor to store any materials offsite, he shall first obtain the approval of the Architect. The Contractor shall be responsible for insurance and warehousing charges of any materials stored offsite. The Contractor shall also be responsible for the cost of delivery to the job site of any materials that have been stored offsite.

B. Materials delivered to the job site shall be carefully stored and protected from damage. Damaged material shall not be used in the work. The Contractor shall provide, where directed temporary storage facilities as may be required for the storage of all materials which might be damaged by weather.

C. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the representative manufacturers, unless otherwise specified.

D. Equipment, plant, and appliances, such as hoists, centering, concrete lifts, construction elevators, cranes, rigging, towers, derricks, walks, ramps, chutes, scaffolding, implements, transportation, cartage and other things necessary and required for the adequate execution of the work and as required by law and applicable Union rules shall be provided and shall be maintained in good and safe mechanical working order, be responsible for their safe use, and remove them when no longer required. Applicable requirements of OSHA shall become and form a part of this document.

E. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

F. To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

G. Require installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

H. Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Contract Documents.

I. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.

J. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerance if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

K. Recheck measurements and dimensions of the work as an integral step of starting each installation.

L. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

M. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.

N. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. In CMU walls mount units at height closest to manufacturer's recommendation so as to minimize cutting of block coursings. Refer questionable mounting height choices to Architect for final decision.

END OF SECTION 016000

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SECTION 01 60 00

REGULATORY REQUIREMENTS

## PART 1.00 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Contract Provisions and the General Requirements of Division 1 apply to the work of this Section.

B. Particular coordination is required in connection with Sections for Demolition which must be recognized as containing supplements to this Section of the Specifications.

1.02 LAWS, CODES, ORDINANCES, PERMITS, FEES, ETC.

A. All necessary permits from the municipal or other public authorities shall be secured and paid by the Contractor who shall give all notices required by Law, Municipal Ordinances, or the Rules and Regulations of the various Municipal Bureaus or Departments, and also as a part of the Contract, shall comply with all Federal and State laws and all Municipal Ordinances or Regulations that may be applicable to this work which shall be issued (in compliance with Ordinances or Regulations existing at the time of Notice to Proceed) by any or all of said Departments as applying to the work of the Contract.

B. Wherever in these Specifications the name of an Official, Bureau or Department is mentioned, it is intended to mean that Official, Bureau, or Department having jurisdiction.

C. The Contractor shall deliver to the Owner all permits or certificates of approval and inspections issued by all Agencies having jurisdiction in connection with this work, before the certificate for final payment is issued.

D. Laws, Codes, Provisions - Comply with:

1. New York State Building Code

2. NFPA 101

3. OSHA

4. Westchester County Department of Health – Air Quality Control

5. See other codes and ordinances referenced therein.

6. In case of conflicting requirements between the various codes, the Contract Documents or any other Local and State Codes or Ordinances having jurisdiction, the most stringent shall govern.

E. It is the intention of these Contract documents that the contractor's work be fully in compliance with all applicable codes and ordinances and that the cost of such compliance is included in the Contract Price. If there are errors or omissions in the contract documents which would result in work that was not in compliance with all the applicable codes and ordinances then the contractor shall not proceed but shall notify the architect in writing. The Contractor shall have included in the contract price the cost of all such work even in the case of errors or omissions to the contract documents if such errors and omissions could have been readily ascertainable through the exercise of reasonable diligence by the contractors.

END OF SECTION 01 60 00

# SECTION 01 73 00- PROJECT EXECUTION

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

### 1.2 SECTION INCLUDES

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. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

### 1.3 RELATED SECTIONS

A. Cutting and Patching - Section 01 73 29.

B. Closeout Procedures - Section 01 78 00.

### 1.4 SUBMITTALS

A. Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by land surveyor.

E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

**PART 2 PRODUCTS**

(Not Applicable)

**PART 3 EXECUTION**

3.1 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: Before beginning site work, 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.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility 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.

3.3 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 promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.

5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. 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.

E. 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.

3.4 FIELD ENGINEERING

A. 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.

B. Benchmarks: Establish and maintain a minimum of two 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.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 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. 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.

G. 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.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 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.

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: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. 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.

I. 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.

J. 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.

K. 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.

3.7 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."

3.8 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.

3.9 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

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# SECTION 01 73 29- CUTTING AND PATCHING

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

### 1.2 SECTION INCLUDES

A. This Section includes procedural requirements for cutting and patching. Each Prime Contractor is responsible for their own cutting and finish patching.

### 1.3 RELATED SECTIONS

A. Refer to Divisions 3 through 34 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 22, 23 and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

### 1.4 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.

### 1.5 SUBMITTALS

A. Cutting and Patching: Submit a method describing procedures at least **10 days before** the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how

long service will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.6 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.

1. Provide a list of additional elements that are structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.

2. Air or smoke barriers.

3. Fire-protection systems.

4. Control systems.

5. Communication systems.

6. Conveying systems.

7. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following 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 results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.

2. Membranes and flashings.

3. Exterior curtain-wall construction.

4. Equipment supports.

5. Piping, ductwork, vessels, and equipment.

6. Noise- and vibration-control elements and systems.

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.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding

1.7 WARRANTY

A. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void warranties.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. In-Place Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing 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

3.1 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 existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 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. In-Place Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. 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 of these Specifications.

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.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty and similar materials.

END SECTION 01 73 29

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# SECTION 01 74 13

# CLEANING UP

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

The Contractor must employ at all times during the progress of his work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

### 1.2 BASIS OF PAYMENT

Construction of the new public works facility.

### 1.3 RELATED WORK:

A. Section 00 72 00 STANDARD GENERAL CONDITIONS
B. Section 01 11 00 CONTROL OF WORK AND MATERIALS
C. Section 01 14 00 SPECIAL PROVISIONS

## PART 2 – PRODUCTS (Not used)

## PART 3 - EXECUTION

### 2.1 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

2.2 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

2.3 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools and machinery or other construction equipment furnished by him; shall remove all rubbish from any grounds which he has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by his operations in a neat and satisfactory condition.

2.4 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as directed, any property damaged by his work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

2.5 FINAL CLEANUP:

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.

B. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the building to a "like new" condition. This cleanup shall include removing all trash and debris from the premises; sweeping and mopping of all floors; washing of all walls, windows and doors; cleaning and polishing of all finish metal surfaces; cleaning of all equipment, utilizing proper solvents for removal of oil and grease; cleaning of dirt and debris out of all mechanical and electrical cabinets; and all other related work required to render the building suitable for use. Before acceptance, the Engineer shall approve the condition of the building.

END OF SECTION 01 74 13

# SECTION 01 74 19

# CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## 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 administrative and procedural requirements for the following:

1. Disposing of non-hazardous demolition and construction waste.

B. Related Sections include the following:

1. Division 01 Section “Temporary Facilities and Controls” for environmental-protection measures during construction, and location of waste containers at Project site.

### 1.3 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.

1.4 SUBMITTALS

A. 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.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or 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. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 19

# SECTION 01 75 00
# STARTUP AND TESTING

## PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section includes the startup and testing services required during system startup.

1.02 SYSTEM DESCRIPTION:

A. The Contractor shall perform startup to the satisfaction of the Engineer and Owner. Startup and testing shall not be initiated until all required certifications and other required documentation has been submitted, as described herein.

B. The purpose of the startup test is to provide a final operational checkout of all equipment prior to beneficial use by the Owner.

C. Substantial Completion of the project shall not be certified until successful completion of startup.

1.03 RELATED WORK:

A. Section 01 75 13, EQUIPMENT CHECKOUT AND TESTING

B. Section 01 90 00, COMMISSIONING

B. Divisions 11 through 33

1.04 SEQUENCING:

Testing, operator training and other like services to be provided under the technical sections of the specifications are not to be performed during startup without written authorization from the Engineer.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF THE GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Three copies of the following shall be forwarded to the Engineer for review two (2) weeks prior to commencement of startup:

1. Certification by a representative of the manufacturer that each piece of equipment has been installed properly and is ready for operation.

2. Certification by a representative of the equipment manufacturer that all equipment requiring calibration has been properly calibrated.

3. A schedule of the testing, including staffing, and specific testing and operation of individual equipment items.

B. At the conclusion of the test, all information recorded during the test shall be forwarded to the Engineer.

C. This test is not to be utilized as a general debugging of the system. All equipment shall be started, tested and calibrated prior to this test. This includes automatic and manual operation as well as instrumentation interfacing.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 PREPARATION:

A. Prior to commencement of testing, the Engineer shall be given three (3) days' written notice.

B. The Contractor shall complete final debugging prior to startup.

C. All telemetry equipment shall be operational prior to testing.

D. The test shall be performed.

E. Part of the test shall be accomplished on standby power.

3.02 TEST PROCEDURES:

A. It is the general responsibility of the Contractor to insure that all equipment is completely operational throughout the test; provide the Engineer with proper technical assistance as required to completely test all equipment and alarms; provide adequately trained personnel who can operate equipment on an on/off basis so that the equipment is not damaged, whether the Engineer or Owner is present or not during that portion of the test.

B. It is the general responsibility of the Engineer and Owner during the test period to supervise the testing of all equipment, associated alarms and devices; to vary the operation of the equipment as necessary.

3.03 STOPPING OF TEST:

A. The Engineer shall stop the testing for any of the following reasons:

1. Failure of critical system, including:

a. Pumps
b. HVAC Equipment
c. Industrial Equipment
b. Telemetry Equipment
c. Instrumentation
d. Standby Generating System
e. Additional equipment as indicated in the Contract Documents

2. Failure of any of the above systems to operate on standby power.

B. If the test is stopped for any reason, the test shall be restarted from the beginning. The Contractor shall pay all costs associated with the Owner and Engineer supervising additional testing as required.

3.04 EXPENDABLES:

Unless otherwise indicated, the General Contractor shall be responsible for providing all fuel during construction.

END OF SECTION

# SECTION 01 75 13
# EQUIPMENT CHECKOUT AND TESTING

## PART 1 - GENERAL

1.01 DESCRIPTION:

A. The physical checkout and testing requirements in this Section are in addition to those requirements defined in the technical specifications.

1.02 RELATED WORK:

A. Section 01 75 00, STARTUP AND TESTING

B. Section 01 90 00, COMMISSIONING

C. Division 11 through Division 33

1.03 DEFINITIONS:

A. Shop Testing is defined as testing that is performed by the manufacturer either at the place of manufacture, or the place of assembly, for the purpose of proving that the equipment meets the requirements of the technical specification(s).

B. Physical Checkout is defined as the process whereby the Contractor physically inspects products after they have been installed in the work, and certifies that the products have been properly and completely installed, and are ready for field testing.

C. Field Testing is defined as testing that is performed on products by the Contractor with the assistance of the manufacturer's representative, after the performance of physical checkout, for the purpose of proving that the tested products meet the specifications. While field testing can be described as "shop testing in the field", it may be required whether or not shop testing was performed on the product.

D. System Testing is defined as testing performed on a "system" normally comprised of two or more pieces of equipment, after physical checkout and field testing have been completed, for the purpose of proving that the system meets specifications. System testing is described in Section 01 75 00, STARTUP AND TESTING.

E. Manufacturer's representative, sometimes referred to as the Factory-Trained Service Technician, is defined as a person provided by the manufacturer, who is qualified by

training and experience to provide technical and process related advice, and/or assistance, relating to the installation or utilization of the products provided by the manufacturer. Minimum training and experience shall include not less than three years participation in similar work, including no less than three similar projects during this three-year period.

1.04 SHOP TESTING:

A. When required by the specifications, shop testing shall be performed prior to delivery of the equipment or material. If shop testing is not required by the technical specifications, provide shop testing as detailed in Paragraph 1.06. Provide a minimum of fifteen days written notice, indicating the time and place of testing. Submit the following to the Engineer for approval not less than fifteen days prior to this notice.

1. Description of the test - Outline how the tests will conform to the requirements of the specifications.

2. Testing devices that will be used in the tests - description must state how the devices will perform or what they will measure, and the device accuracy. Submit sample measurement results and catalog cuts.

3. Schedule for testing - schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.

4. Test forms - submit samples of all forms used to record and report on shop test data. Forms shall include description of test, test date, equipment used, equipment tested, personnel present, equipment tag ID numbers, and measurements made. Forms shall have a place for signature by the chief testing person, and an officer of the manufacturer certifying that the tests results shown are true, accurate, have met the required criteria, and that the equipment will operate as indicated.

B. Submit the following to the Engineer within one week after completion of the tests.

1. Completed test forms for each device tested.

2. Completed certification.

3. A written summary of testing, reporting results.

4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the specification test requirements at no additional cost to the Owner.

1.05 PHYSICAL CHECKOUT:

A. Physical checkout shall include the following, where applicable:

1. Verify exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, and gates.

2. Verify buildings for structure, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC.

3. Verify concrete structures for structural integrity, finish tolerance, durability, appearance, embedded and inserted items, painting and surface applications.

4. Verify steel structures for member alignment, connection bolt torque, connection weld integrity, painting, fire proofing and surface applications.

5. Verify mechanical systems and items for setting, alignment and securing, check and adjust packing and seals, lubrication, drying out, drive connection and alignment including rotation and belt/chain tension, painting or surface applications, and tagging for project system.

6. Verify piping systems for material, size, components, direction, alignment of joints and bolts/welding, packing and seals, screens and filters and strainers, leak and pressure hydro tests, painting and color coding, hangers and anchors and expansion provision and supports, clean out of foreign matter and tagging for project system.

7. Verify electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit continuity and identification, voltage testing, ground continuity and testing, terminal installation and identification, jar switches and circuit breakers and transformers tested, substation operation tested, and tagging for project system.

8. Verify communication system including telephone, fire/smoke alarm, security, paging, closed circuit TV similar to electrical above.

9. Verify computer systems by station, function, network interface.

10. Each piece of equipment and system must be certified by the manufacturer's representative as described in subsection 1.07.

1.06 SERVICES OF THE MANUFACTURER'S REPRESENTATIVE:

A. Services of manufacturer's representatives shall be provided for equipment and systems specified in Divisions 11 through 48.

B. Contractor shall coordinate services of the various representatives to avoid overlap, thereby ensuring all work may be observed by the Engineer, and the Owner's operating personnel may receive all required training.

C. Contractor shall notify the Engineer in writing not less than ten working days prior to the visit of each manufacturer's representative.

D. Manufacturer's representative shall provide services specified in Divisions 11 through 48. As a minimum, the services shall include the following:

1. When each piece of equipment or system has been installed, including connection of permanent power and control, the equipment or system shall be started up and fully inspected, aligned and adjusted, including provision of lubrication and all pre-operative maintenance.

2. Each piece of equipment or system shall be complete in all respects. Omission of any required items shall be corrected. Lack of discussion in the specifications of components which are necessary to equipment operation will not be accepted as the basis for an extra charge.

3. At the time of the inspection the representative shall provide a minimum of two additional hours to train the Owner's operations personnel in the operation and maintenance of the equipment or system.

4. Upon completion of this work the manufacturer's representative shall forward a copy of the report of his inspection to the Engineer via the Contractor. The report shall be on a form suitable to the Engineer and shall detail the work completed, deficiencies noted and/or corrected, any special instructions, and the names of Owner's personnel who received training. It shall also certify that the installation of the equipment or system is complete, ready for permanent operation, and free from any defects that would void the warranty.

5. Satisfactory certification of all individual equipment and systems must be received by the Engineer prior to the authorization to proceed with the overall start-up operation.

6. The manufacturer's representative shall return at a later date to supervise field tests, assist in start-up and perform any additional training required. Reports of these visits, specifically detailing the results of all field tests, shall be forwarded to the Engineer within 7 days of completion of the services.

1.07 CORRECTIONS TO THE WORK:

Correct any items of work failing to meet the specifications at no additional cost to the Owner. Correct the nonconforming items by re-work, modification, or replacement, at the option of the Engineer. Provide all required labor, materials, and retesting as specified herein, to verify that the equipment or system conforms to the specifications.

1.08 SAFETY:

Conduct all test procedures in compliance with all applicable safety standards and regulations.

END OF SECTION

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SECTION 01 78 00

PROJECT CLOSEOUT

## PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Warranties.
4. Instruction of Owner's personnel.
5. Final cleaning.

1.3 RELATED SECTIONS

A. Execution Requirements - Section 017300.

B. Operating and Maintenance Data - Section 017823

1.4 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. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. 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.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.

9. Submit test/adjust/balance records.

10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

11. Advise Owner of changeover in heat and other utilities.

12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

13. Complete final cleaning requirements, including touchup painting.

14. 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.

1.5 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. Submit pest-control final inspection report and warranty.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

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 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.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

C. 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 list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. 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.

1.7 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. 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 cannot be readily identified and recorded 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.
d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

3. Mark important additional information that was either shown schematically or omitted from original Drawings.

4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy 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. Note related Change Orders, Record Drawings and Product Data, where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

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, Record Drawings and Record Specifications, where applicable.

E. Miscellaneous Record Submittals: 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.

F. All documents are to be submitted in paper and electronic format.

1.8 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 Substantial 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" x 11" 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.

4. Provide electronic copy of all warranties, organized by product.

**PART 2 PRODUCTS**

2.1 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**

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.

2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.

3. Schedule training with Owner with at least seven days' advance notice.

4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.

2. Review of documentation.

3. Operations.

4. Adjustments.

5. Troubleshooting.

6. Maintenance.

7. Repair.

3.2 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. Remove snow and ice to provide safe access to building.
f. 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.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. 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.
m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. 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 01 77 00

# SECTION 01 78 23- OPERATING AND MAINTENANCE DATA

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

### 1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the operating and maintenance data as specified herein.

### 1.3 RELATED SECTIONS

A. Submittal Procedures - Section 01 33 00.

B. Closeout Procedures - Section 01 78 00.

### 1.4 GENERAL

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

1. Contractors shall prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.

### 1.5 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. All documents are to be submitted in paper and electronic format.

C. Format

1. Size: 8-1/2" x 11".

2. Paper: 20 pound minimum, white for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Drawings

a. Provide reinforced punched binder tab, bind in with text.
b. Fold larger drawings to the size of the text pages.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

a. Provide typed description of product, and major component parts of equipment.
b. Provide indexed tabs.

6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:

    a. Title of Project.
    b. Identity of separate structure as applicable.
    c. Identity of general subject matter covered in the manual.

D. Binders

1. Commercial quality three-ring binders with durable and cleanable plastic covers.

2. Maximum Ring Size: 1 inch.

3. When multiple binders are used, correlate the data into related consistent groupings.

1.6 MANUAL FOR MATERIALS AND FINISHES

A. Submit three (3) copies of complete manual in final form.

B. Content, for architectural products, applied materials and finishes

1. Manufacturer's data, giving full information on products.

    a. Catalog number, size, composition.
    b. Color and texture designations.
    c. Information required for re-ordering special-manufactured products.

2. Instructions for care and maintenance.

    a. Manufacturer's recommendation for types of cleaning agents and methods.
    b. Cautions against cleaning agents and methods which are detrimental to the product.
    c. Recommended schedule for cleaning and maintenance.

C. Content, for moisture-protection and weather-exposed products

1. Manufacturer's data, giving full information on products.

    a. Applicable standards.
    b. Chemical composition.
    c. Details of installation.

2. Instructions for inspection, maintenance, and repair.

1.7 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content, for each unit of equipment and system, as appropriate.

1. Description of unit and component parts.

    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of all replaceable parts.

2. Operating procedures

    a. Start-up, break-in, routine and normal operating instructions.
    b. Regulation, control, stopping, shut-down and emergency instructions.
    c. Summer and winter operating instructions.
    d. Special operating instructions.

3. Maintenance procedures

    a. Routine operations.
    b. Guide to "trouble-shooting."
    c. Disassembly, repair and reassembly.
    d. Alignment, adjusting and checking.

4. Servicing and lubrication schedule.

    a. List of lubricants required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

    a. Predicted life of parts subject to wear.
    b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

9. Each contractor's coordination drawings.

    a. As-installed color coded piping diagrams.

10. Charts of valve tag numbers, with the location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.

a. Function, normal operating characteristics, and limiting condition.
b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panel boards.

   a. Electrical service.
   b. Controls.
   c. Communications.

3. As-installed color coded wiring diagrams.

4. Operating procedures

   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

5. Maintenance procedures

   a. Routine operations.
   b. Guide to "trouble-shooting."
   c. Disassembly, repair and reassembly.
   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: The respective sections of Specifications.

END OF SECTION 01 78 23

# SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

### 1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

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 provide information for preparation of corresponding 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. Record data as soon as possible after obtaining it.
   c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file.
2. Record Digital Data Files: Organize digital data 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 digital data file.
3. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect and Construction Manager.
e. Name of Contractor.

## 2.2 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. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

## 2.3 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.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

C. Provide PDF copy of all Project Record Documents on Thumb Drive for Owner

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until 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 Construction Manager's reference during normal working hours.

END OF SECTION 01 78 39

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# DOCUMENT 01 79 00-DEMONSTRATION AND TRAINING

## PART 1 – GENERAL

### 1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

### 1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

### 1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

### 1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in

### 1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.

g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:
a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 – PRODUCTS

PART 3 – EXECUTION

END OF DOCUMENT 017900

# SECTION 01 90 00
# COMMISSIONING

## PART 1 - GENERAL

### 1.1 RESPONSIBLE PERSONNEL

A. Commissioning Authority: (TBD) will act as the Commissioning Authority. The Commissioning Authority works for the Engineer and directs and approves the commissioning work.

B. Responsibility of Disciplines: The parties listed below are part of the commissioning team and will be required to participate in the commissioning process. The responsibilities relative to commissioning for each of these parties is defined in this section.

1. Architect
2. Engineer
3. Owner, including the Owner's Project Manager
4. Construction Manager
5. General Contractor
6. Plumbing Contractor
7. Mechanical Contractor
8. Electrical Contractor
9. Controls Subcontractor
10. Testing, Adjusting and Balancing Subcontractor
11. All other subcontractors that are associated with the above disciplines

### 1.2 DESCRIPTION

A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance.

Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

2. Verify and document proper performance of equipment and systems in all seasons.

B. This project will have selected building systems commissioned in accordance with IECC 2018, as adopted in the 2020 Energy Conservation Construction Code of New York State. The commissioning process will be directed by a Commissioning Authority (CA) whose services will be provided by the Engineer. All correspondence will flow through the Owner's Project Manager (PM).

C. Abbreviations. The following are common abbreviations used in the *Specifications* and in the commissioning process.

| | | | |
|---|---|---|---|
| A/E- | Architect and design engineers | FT- | Functional performance test |
| CA- | Commissioning authority | GC- | General contractor (prime) |
| CC | Controls contractor | MC- | Mechanical contractor |
| CM- | Construction Manager | PC- | Prefunctional checklist |
| | | PM- | Project manager (of the Owner) |
| Cx- | Commissioning | Subs- | Subcontractors to General |
| EC- | Electrical contractor | TAB- | Test and balance contractor |

1.3 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning Authority (CA), the Project Manager (PM), the designated representative of the Construction Management firm (CM), the General Contractor (GC or Contractor), the architect and design engineers, the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. The Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CA directs and coordinates the commissioning activities through the CM. All members of the Commissioning Team work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

C. Scheduling. The CA will work with the CM according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM for scheduling commissioning activities. The CM will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. As construction progresses more detailed schedules are developed by the CA and incorporated into the project schedule by the CM.

1.4 COMMISSIONING PROCESS

A. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a scoping meeting conducted by the CA wherein the commissioning process is reviewed with the commissioning team members and a preliminary plan is issued.

2. Two Additional meetings scheduled by the CA will be required during construction, to plan, scope, coordinate, and schedule future activities. The CA will note equipment installation and startup issues while on-site for the two commissioning meetings and issue a follow-up site visit report.

3. Equipment documentation shall be submitted to the Engineer during normal submittals, including detailed start-up procedures. The CM will copy the CA on all equipment that is to be tested. The CA will use this information to create test procedures.

4. The CA may request additional information for manufacturers test procedures by submitting all requests through the CM who will forward to the contractor.

5. The Subcontractors develop startup checklists and prefunctional tests which are provided to the CM who will forward to the CA.

6. The Subcontractors execute and document the prefunctional checklists and perform startup and initial checkout.

7. The CA develops specific equipment and system functional performance test procedures. The Subcontractors review the procedures.

8. Functional Testing can only begin after Subcontractors provide written notice to CA that all startup and prefunctional checklists have been completed. The procedures are executed by the Subcontractors, under the direction of, and documented by the CA.

9. Preliminary Commissioning Report is issued by CA before Final Inspection can be performed by The Engineer.

10. Contractors submit O&M manuals for review by CA and Engineer.

11. Contractors perform seasonal tests as directed by the CA.

12. Final Commissioning report is issued by the CA after Contractor has addressed open issues and seasonal testing has been completed.

## 1.5 RELATED WORK

A. All of the following sections apply to the Work of this section.

11 11 26 Vehicle Washing Equipment
22 00 00 Plumbing
23 00 00 Heating Ventilating and Air Conditioning
26 00 00 Electrical

1.6 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project. Testing requirements are part of this section. Each member of the commissioning team shall review all test procedures in this section to determine if his/her presence is required for each test.

| **Equipment and System** | **Functional Test Requirements Specified In:** |
|---|---|
| Domestic Hot Water Heating | 3.7 |
| Variable Volume air handling units and VAV boxes | 3.8 |
| Makeup air unit | 3.9 |
| Miscellaneous metering, heating & cooling systems | 3.10 |
| Hot water heating systems | 3.11 |
| TAB for Air and Water | 3.12 |
| Electrical Lighting sensors and timers | 3.13 |

1.7 RESPONSIBILITIES

A. The responsibilities of all parties in the commissioning process are provided in this section. The parties are as follows:
1. Architect
2. Design Engineer
3. Commissioning Authority
4. Construction Manager
5. Owner's Project Manager
6. Plumbing Contractor
7. HVAC Mechanical Contractor
8. TAB Subcontractor
9. Controls Subcontractor
10. Electrical Contractor
11. Manufacturers' Representative for Commissioned Equipment

B. Architect (or A/E):

1. Construction Phase

a. Attend the commissioning scoping meeting and selected commissioning team meetings.

b. Provide any design narrative documentation requested by the CA.

c. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.

*2. Acceptance Phase*

a. Coordinate resolution of design non-conformance and design deficiencies identified during commissioning.

C. Design Engineer:

*1. Construction Phase*

a. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

2. Acceptance Phase

a. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.

D. Commissioning Authority (CA):

The primary role of the CA is to observe and document performance—confirming that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will demonstrate all tools or the use of tools to start, check-out and functionally test equipment and systems as requested by the CA.

*1. Construction Phase*

a. Coordinate the commissioning work and, with the CM, ensure that commissioning activities are being scheduled into the master schedule.

b. Plan and conduct a commissioning scoping meeting and other commissioning meetings as necessary.

c. Before startup, gather and review the submittals and control sequences. Work with contractors and design engineers until sufficient clarity has been obtained to write detailed testing procedures.

d. Review submittals for systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews. Provide feedback to the Engineer.

e. Perform two site visits to observe component and system installations. Obtain information on construction progress from the CM.

f. Approve systems startup by reviewing start-up reports and by selected site observation.

g. Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.

h. Prepare functional performance test procedures for specific systems.

2. Acceptance Phase

a. Coordinate, witness and approve manual functional performance tests performed by installing contractors.

b. Analyze functional performance trend logs and monitoring data to verify performance.

c. Maintain a master deficiency and resolution log and a separate testing record. Provide the CM with written progress reports and test results.

d. Prepare a preliminary commissioning report

e. Review O&M manuals

f. Prepare a final commissioning report.

E. Construction Manager (CM):

*1. Construction Phase*

a. Facilitate the coordination of the commissioning work by the CA, and, with the CA, ensure that commissioning activities are being scheduled into the master schedule.

b. Attend a commissioning scoping meeting and other commissioning team meetings.

c. Perform the normal review of Contractor submittals. Provide copies of data pertaining to all equipment that will be commissioned to the CA.

*2. Acceptance Phase*

a. Review commissioning progress and deficiency reports.

b. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.

F. Mechanical, Controls and TAB Contractors:

The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23 are as follows (all references apply to commissioned equipment only):

*1. Construction Phases*

a. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.

b. Provide the CM with normal cut sheets and shop drawing submittals of commissioned equipment. The CM will forward a copy to the CA.

c. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

d. Provide assistance to the CA in preparing the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

e. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures for all commissioned equipment. Submit to CA for review.

f. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.

g. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems. Notify CA in writing when complete.

2. Acceptance Phase

a. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

b. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment. Assist the CA in interpreting the monitoring data, as necessary.

c. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, CM and A/E and retest the equipment.

d. Make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in testing.

G. Mechanical Contractor:

The responsibilities of the HVAC mechanical contractor, during Construction Phases in addition to those listed in (F) are:

1. Assist and cooperate with the TAB contractor and CA by putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.

2. List and clearly identify on the as-built drawings the locations of all air-flow stations and duct static pressure measuring points.

3. Notify the CM, who will notify the CA, of time and date for startup of each piece of equipment and TAB will occur. Be responsible to notify the CM ahead of time, when commissioning activities not yet performed will delay construction.

H. Controls Contractor:

1. The commissioning responsibilities of the controls contractor, during Construction Phases in addition to those listed in section (F) above are:

2. Sequences of Operation Submittals:

a. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

1) All interactions and interlocks with other systems.

2) <u>Detailed delineation of control between any packaged controls and the building automation system,</u> listing what points the BAS monitors only and what BAS points are control points and are adjustable.

3) <u>Written sequences of control for packaged controlled equipment.</u>

4) Effects of power or equipment failure with all standby component functions.

5) Sequences for all alarms and emergency shutdowns.

6) Initial values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff.

7) Schedules, if known.

3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

4. Assist and cooperate with the TAB contractor in the following manner:

a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).

b. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

5. Assist and cooperate with the CA in the following manner:

a. Meet with the CA to review and explain how each control program is written relative to the specification and the control submittals. Provide detailed information to the CA on all setpoints (occupied, unoccupied, warmup), schedules, time delays, control differentials, interlocks, etc.

b. Using a skilled technician who is familiar with this building, execute the functional test procedures of the controls system as directed by the CA.

6. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing.

7. Provide a signed and dated certification upon completion of the checkout of each controlled device, equipment and system prior to functional testing that all system programming is complete except for functional testing requirements.

8. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

I. TAB Contractor: The duties of the TAB contractor, in addition to those listed in (H):

1. Submit the outline of the TAB plan and approach for each system and component to the CM and the controls contractor six weeks prior to starting the TAB. The CM shall forward to the CA.

2. The submitted plan will include:

   a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.

   b. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

   c. Final test report forms to be used.

   d. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed.

   e. Details of how *total* flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).

   f. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.

   g. Details of how minimum outside air cfm will be verified and set.

3. Submit hand-written reports of discrepancies, deficient or uncompleted work by others and lists of completed tests to the CA and CM at least twice a week.

4. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

5. Provide a draft TAB report within two weeks of completion.

6. Provide a final TAB report for the CA with details, as in the draft.

7. Conduct functional performance tests and checks on the original TAB as specified as requested by the CA.

J. Plumbing Contractors: The commissioning responsibilities applicable to the electrical contractor are as follows *(all references apply to commissioned equipment only)*:

1. Construction Phase

   a. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.

b. Contractors shall provide normal cut sheets and shop drawing submittals to the CM of commissioned equipment. CM will forward the CA a copy.

c. Provide additional requested documentation to the CA for development of start-up and functional testing procedures.

d. Provide labor in assistance to the CA in preparation of the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

e. Address current A/E punch list items before functional testing.

2. Acceptance Phase

a. Provide skilled technicians, the required test equipment, and miscellaneous equipment and materials to execute starting of equipment and to execute the functional performance tests.

b. Perform functional performance testing under the direction of the CA for specified equipment. Assist the CA in interpreting the monitoring data.

c. Correct deficiencies (differences between specified and observed performance and applicable Standards) as interpreted by the CA, CM and A/E and retest the equipment.

K. Electrical Contractors: The commissioning responsibilities applicable to the electrical contractor are as follows *(all references apply to commissioned equipment only)*:

1. Construction Phases

a. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.

b. Contractors shall provide normal cut sheets and shop drawing submittals to the CM of commissioned equipment. CM will forward the CA a copy.

c. Provide additional requested documentation to the CA for development of start-up and functional testing procedures.

d. Provide labor in assistance to the CA in preparation of the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

e. Address current A/E punch list items before functional testing.

2. Acceptance Phase

a. Provide skilled technicians, the required test equipment, and miscellaneous equipment and materials to execute starting of equipment and to execute the functional performance tests.

b. Perform functional performance testing under the direction of the CA for specified equipment. Assist the CA in interpreting the monitoring data.

c. Correct deficiencies (differences between specified and observed performance and applicable Standards) as interpreted by the CA, CM and A/E and retest the equipment.

1.8 TESTING REQUIREMENTS

A. Specific functional testing requirements are listed for each system in Part 3 of this section. The Commissioning Authority (CA) shall develop step-by-step procedures to be executed by the Subs as directed by the Commissioning Authority.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor shall be responsible for all standard testing equipment for the HVAC system and controls system except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the Division Controller.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications.* Electrical test equipment shall meet the calibration requirements of the latest edition of NETA specifications.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting

1. Within 30 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning

team in attendance. A preliminary testing plan will be distributed to all parties by the CA.

B. Miscellaneous Meetings:

1. Two other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will schedule these meetings with the CM to be a part of the construction meeting and will minimize unnecessary time being spent by Subs.

## 3.2 SUBMITTALS

A. The Commissioning Authority will review and comment on all submittals related to the commissioned equipment to assist in the development of test procedures.

B. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

## 3.3 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. General - The following procedures apply to all equipment to be commissioned:

1. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

B. Start-up and Initial Checkout Plan:

1. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for executing functional performance tests are identified in the testing requirements for each system.

2. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets.

3. The subcontractor submits the full startup plan to the CA for review.

C. Execution of Prefunctional Checklists and Startup:

1. The CA shall review the checklists provided by the Contractor for each type of equipment to be commissioned.

2. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.

D. Deficiencies, Non-Conformance and Approval in Checklists and Startup:

1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully.

2. The CA reviews the report and submits either a non-compliance report or an approval form to the Sub or CM which indicates system is ready for functional testing.

3. <u>Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party.</u>

## 3.4 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. The general list of equipment to be commissioned is found in this section.

C. The parties responsible to execute each test are listed with each test.

D. Objectives and Scope:

1. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

2. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

E. Development of Test Procedures:

1. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters.

2. The CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall provide assistance to the CA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty.

F. Test Methods:

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers.

2. Setup:
   a. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems to their pre-test condition.

3. Sampling:
   a. The recommended sampling rates are specified with each type of equipment in the testing sections of this specification. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

G. Coordination and Scheduling:

1. The Subs shall provide sufficient notice to the CA and CM regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the CM and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

## 3.5 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation:

1. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the CM for review and approval and to the Subs for review.

B. Non-Conformance:

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be reported to the CM.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.

4. Cost of Retesting:

   a. The cost for the *Sub* to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM.

   b. The time for the CA and CM to direct any retesting required because a specific *prefunctional* checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the responsible contractor.

5. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

C. Approval:

1. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the CM, if necessary. The CA recommends acceptance of each test to the CM using a standard form. The CM gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

2. When functional testing of each system is approved by the CA, he/she will recommend to the CM and Owner that the system be considered substantially complete.

## 3.6 DEFERRED TESTING

A. Seasonal Testing:

1. During the Acceptance Phase, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity with the CM. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.7 DOMESTIC HOT WATER HEATING SYSTEM TEST REQUIREMENTS

A. Parties Responsible to Execute Functional Test:

1. Plumbing Contractor: Operate the controls, as needed
2. CA: To witness, direct and document testing
3. Balancing Contractor to verify flows

B. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

1. Domestic HW circulating pumps
2. Hot water boilers

C. Prerequisites:

1. None

D. Functions/Modes Required To Be Tested, Test Methods and Seasonal Test Requirements.

1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Function / Mode | Test Method Manual, Monitoring, Either or Both | Required Seasonal Test[1] |
|---|---|---|
| General | | |
| 1. Temperature control of boiler at full load | Both | Heating |
| 2. Control of hot water circulating pump(s) | Monitoring | Heating |
| 3. Verify schedules and setpoints to be reasonable and appropriate | Monitoring | Both |
| | | |

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

E. Special Procedures (other equipment to test with, etc.; reference to function ID):

F. Acceptance Criteria (referenced by function or mode ID):

1. For the conditions, sequences and modes tested, the boilers, integral components and related equipment respond to varying loads and changing conditions and

parameters appropriately as expected, as specified and according to acceptable operating practice.

G. Sampling Strategy for Identical Units: No sampling, test all.

END OF REQUIREMENTS FOR HOT WATER HEATING SYSTEM TEST

## 3.8 VARIABLE VOLUME AIR HANDLING UNIT

A. Equipment to be tested
   1. AHU and associated VAV boxes, reheat coils and variable airflow sequences.

B. Parties Responsible to Execute Functional Test

   1. Controls Contractor: Operate the controls to activate the equipment.
   2. CA: To witness, direct and document testing.
   3. TAB Contractor to verify air and water flows.
   4. Mechanical Contractor to fix any problems.
   5. Unit Manufacturer's Representative.

C. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

   1. Hot water heating system distribution to unit heating section
   2. VAV boxes, reheat coils and associated radiation (if applicable)
   3. VFDs
   4. Unit manufacturers packaged controls startup checklist and tests
   5. Communication interface between building control system and packaged controls including all point mapping and naming.

D. Prerequisites:

   1. The applicable prerequisite checklist items listed in Part 1 of this section and paragraph C above shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

E. Functions/Modes Required To Be Tested, Test Methods :

   1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Function / Mode | Test Method Manual, Monitoring, Either or Both[2] | Required Seasonal Test[1] |
|---|---|---|
| General<br>1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. | Manual | |
| In addition to, or as part of (1) above, the following modes or tests are required: | | |
| 2. Hot water coil temperature control blend pump operation | Both | Heating |
| 3. Economizer functions | Both | Cooling |
| 4. SF, RF interlocks | Either | |
| 5. Operation and staging of compressors | Both | Cooling |
| 6. Damper interlocks and correct modulation in all modes, including fire and smoke dampers. | Manual | |
| 7. Temperature difference across heating and cooling coils | Manual | Both |
| 8. Smoke detectors and smoke evac from fire alarm control panel. | Manual | |
| 9. Verify TAB reported OA, SF and RF CFM with control system reading at minimum and maximum airflows. | Manual | |
| 10. All alarms (low limits, high static, freezestat, etc.) | Manual | |
| 11. Supply and return fans volume matching control | Monitoring | Design |
| 12. CO2 demand ventilation control routine. | Monitoring | |
| 13. Operation during occupied, unoccupied and warmup modes. | Manual | |
| 14. Verify no hunting or significant overshoot by valves and dampers. | Monitoring | Both |
| 15. Verify by measurement, HCV positive shutoff (no leak-thru) | Manual | |
| 16. Sensor and actuator calibration checks on: SAT, MAT, OSAT, economizer and RA dampers and other random checks. | Manual | |
| 17. Trend all temperature, air volume, pressure, fan speed and damper control points from the start of functional performance testing until Acceptance Phase is complete. Provide CA with all requested data. | Monitoring | Both |
| 18. Supply and return fans static pressure and volume matching control | Monitoring | Design |
| 19. VAV boxes occupied, unoccupied and warmup modes. | Manual | |
| 20. Verify control parameters and setpoints to be reasonable and appropriate by reviewing the full program of each type of TU. Verify the max. and min. cfm setpoints of all tested TU's against the control drawing and TAB values. Verify other TU programming parameters such as K-factors, deadbands, setpoints, stroke times, etc. | Observation | |

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.
[2]Refer to Special Procedures

F. Special Procedures (other equipment to test with, etc.; reference to function ID): None

G. Acceptance Criteria (referenced by function or mode ID):

1. For the conditions, sequences and modes tested, the TU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. Space temperature during occupied modes shall maintain specified tolerances without excessive hunting of the coil valve or complaints of drafts or stuffiness from occupants.

H. Sampling Strategy for Identical:
1. Perform 100% test of AHU and all associated components.
2. Perform 25% test of all VAV boxes and radiation (if installed) associated with each air handling unit.
3. Monitoring:
   a. All rooms shall be monitored

END OF REQUIREMENTS FOR VARIABLE VOLUME UNIT TESTS

3.9 MAKEUP AIR UNIT

A. Equipment to be tested
1. Makeup air unit and associated fan, heating and cooling coils and sequences.

B. Parties Responsible to Execute Functional Test

1. Controls Contractor: Operate the controls to activate the equipment.
2. CA: To witness, direct and document testing.
3. TAB Contractor to verify air and water flows.
4. Mechanical Contractor to fix any problems.
5. Unit Manufacturer's Representative.

C. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

1. Hot water heating system distribution to unit heating section
2. VFDs
3. Unit manufacturers packaged controls startup checklist and tests
4. Communication interface between building control system and packaged controls including all point mapping and naming.

D. Prerequisites:

1. The applicable prerequisite checklist items listed in the Part 1 of this section and paragraph C above shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

E. Functions/Modes Required To Be Tested, Test Methods :

1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Function / Mode | Test Method Manual, Monitoring, Either or Both[2] | Required Seasonal Test[1] |
|---|---|---|
| General<br>1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. | Manual | |
| In addition to, or as part of (1) above, the following modes or tests are required: | | |
| 2. Hot water coil temperature control blend pump operation | Both | Heating |
| 3. SF, RF interlocks | Either | |
| 4. Damper interlocks and correct modulation in all modes, including fire and smoke dampers. | Manual | |
| 5. Temperature difference across heating and cooling coils | Manual | Both |
| 6. Smoke detectors and smoke evac from fire alarm control panel. | Manual | |
| 7. Verify TAB reported OA, SF and RF CFM with control system reading at minimum and maximum airflows. | Manual | |
| 8. All alarms (low limits, high static, freezestat, etc.) | Manual | |
| 9. Operation during occupied, unoccupied and warmup modes. | Manual | |
| 10. Verify control parameters and setpoints to be reasonable and appropriate. Verify the max. and min. cfm setpoints. Verify and record all packaged unit programming parameters. | Observation | |
| 11. Verify proper operation in both cooling and heating modes under occupied and unoccupied conditions. | Both | Both |
| 12. Verify no hunting or significant overshoot by valves and dampers. | Monitoring | Both |
| 13. Verify by measurement, HCV positive shutoff (no leak-thru) | Manual | |
| 14. Trend all temperature, air volume, pressure, fan speed and damper control points from the start of functional performance testing until Acceptance Phase is complete. Provide CA with all requested data. | Monitoring | Both |
| 15. Verify control strategies, schedules and setpoints to be reasonable and appropriate | | |

Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.
[2]Refer to Special Procedures

F. Special Procedures (other equipment to test with, etc.; reference to function ID): None

G. Acceptance Criteria (referenced by function or mode ID):

1. For the conditions, sequences and modes tested, the TU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. Space temperature during occupied modes shall maintain specified tolerances without excessive hunting of the coil valve or complaints of drafts or stuffiness from occupants.

H. Sampling Strategy for Identical:
1. Perform 100% test of AHU and all associated components.
2. Monitoring:
   a. All rooms shall be monitored

END OF REQUIREMENTS FOR MAKEUP AIR UNIT TESTS

## 3.10 MISCELLANEOUS EXHAUST FANS, HEATING & COOLING SYSTEMS

A. Equipment to be tested

1. Split DX systems
2. Cabinet Unit Heaters.
3. Exhaust fans
4. Gas Fired Radiant Heaters
5. Destratification Fans

B. Parties Responsible to Execute Functional Test

1. ATC Sub-subcontractor: Operate the controls to activate the equipment.
2. CA: To witness, direct and document testing.
3. TAB Sub-subcontractor to verify air and water flows.
4. HVAC Subcontractor to fix any problems.
5. Unit Manufacturer's Representative.

C. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

1. Split DX system
2. Hot water heating system
3. Exhaust Fans
4. Gas fired radiant heaters

D. Prerequisites:

1. The Contractor shall provide completed manufacturers startup checklists and complete system balancing report prior to the start of functional testing.

E. Functions/Modes Required To Be Tested, Test Methods :

1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Function / Mode | Test Method Manual, Monitoring, Either or Both[2] | Required Seasonal Test[1] |
|---|---|---|
| General<br>1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of each piece of equipment or system in all control strategies or interlocks that it is associated with. | Manual | |
| In addition to, or as part of (1) above, the following modes or tests are required: | | |
| 2. Hot water coil temperature control functions | Both | Heating |
| 3. Temperature difference across heating coils | Manual | Both |
| 4. All alarms (low limits, freezestat, compressor lockout, etc.) | Manual | |
| 5. Occupied, unoccupied and warmup modes. | Manual | |
| 6. Verify control parameters and setpoints to be reasonable and appropriate by reviewing the full program of each type of TU. | Observation | |
| 7. Verify no hunting or significant overshoot by exhaust fan speeds, valves and dampers. | Monitoring | |
| 8. Verify by measurement, HCV positive shutoff (no leak-thru) | Manual | |
| 9. Trend all fan speed, temperature and valve control points from the start of functional performance testing until Acceptance Phase is complete. Provide CA with all requested data. | Monitoring | Both |
| 10. Verify control strategies, schedules and setpoints to be reasonable. | | |

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.
[2]Refer to Special Procedures

F. Special Procedures (other equipment to test with, etc.; reference to function ID): None

G. Acceptance Criteria (referenced by function or mode ID):

1. For the conditions, sequences and modes tested, the TU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

2. Space temperature during occupied modes shall maintain specified tolerances without excessive hunting of the coil valve or complaints of drafts or stuffiness from occupants.

3. Exhaust fans and associated makeup air terminal units track to maintain spaces within specified parameters for temperature and pressure.

H. Sampling Strategy for Identical:

1. Test 100% of each type of terminal unit noted in this section.

2. Monitoring:

a. All rooms shall be monitored

- END OF REQUIREMENTS FOR MISCELLANEOUS HEATING & COOLING SYSTEMS TESTS -

3.11 HOT WATER HEATING SYSTEM TEST REQUIREMENTS

A. Parties Responsible to Execute Functional Test:

1. Controls Contractor: Operate the controls, as needed
2. HVAC mechanical contractor or vendor: Assist in testing sequences
3. CA: To witness, direct and document testing
4. Balancing Contractor to verify flows

B. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

1. Building HW supply pumps
2. Hot water boilers

C. Prerequisites:

1. None

D. Functions/Modes Required To Be Tested, Test Methods and Seasonal Test Requirements.

1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Function / Mode | Test Method Manual, Monitoring, Either or Both | Required Seasonal Test[1] |
|---|---|---|

| Function / Mode | Test Method Manual, Monitoring, Either or Both | Required Seasonal Test[1] |
|---|---|---|
| General | | |
| 1. Supply pump staging, bypass valve operation, HWT reset. Control of system differential pressure, verification of program settings,, alarms, etc. | Both | Heating |
| 2. Constancy of differential pressure (pump control parameter) | Monitoring | Heating |
| 3. Trend all temperature, differential pressure, speed and control points from the start of functional performance testing until Acceptance Phase is complete. | Monitoring | Both |
| 4. Verify schedules and setpoints to be reasonable and appropriate | | |
| 5. | | |
| | | |

[1]Cooling season, Heating season or Both. "Design" means within 5°of season design (ASHRAE 2 1/2%), or 95% of loading design. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

E. Special Procedures (other equipment to test with, etc.; reference to function ID):

F. Acceptance Criteria (referenced by function or mode ID):

1. For the conditions, sequences and modes tested, the boilers, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

G. Sampling Strategy for Identical Units: No sampling, test all.

END OF REQUIREMENTS FOR HOT WATER HEATING SYSTEM TEST

## 3.12 TEST AND BALANCE WORK (TAB) TEST REQUIREMENTS

A. Parties Responsible to Execute Functional Test:

1. TAB Contractor: Perform checks using test instruments.
2. Controls Contractor: Operate the controls to activate the equipment.
3. CA: To witness, direct and document testing.
4. Mechanical Contractor to assist in accessing or fixing equipment.

B. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

1. TAB water-side
2. TAB air-side
3. TAB equipment and systems

C. Prerequisites

1. Completed (Typed) Testing, Adjusting and Balancing Report stamped by the responsible certified balancing contractor.

D. Purpose:

1. The purpose of this test is to spot check the TAB work to verify that it was done in accordance with the contract documents and acceptable practice and that the TAB report is accurate.

E. The following tests and checks will be conducted. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Test or Check | Test Method | Required Seasonal Test[3] |
|---|---|---|
| 1. A random sample of up to 20 % of the TAB report data shall be selected for verification (air velocity, air or water flow rate, pressure differential, electrical measurement, etc.). The original TAB contractor will execute the checks, witnessed by the commissioning authority. The controls contractor will demonstrate that flow readings match (within the range specified) those read by the balancer. The TAB contractor will use the same test instruments as used in the original TAB work. | Demonstration | |
| 2. Verify that final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked by the TAB Contractor. | Demonstration | |
| 3. Verification that the air system is being controlled to the lowest possible airflow while still meeting design loads and minimum flow requirements for unit DX coil. | Demonstration | |
| 4. Verification that the water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during a call for full heating that at least one valve is wide open in the longest leg. | Demonstration | |

All readings shall be within 10% of the values shown on the balancing report

F. Special Procedures (other equipment to test with, etc.; reference to function ID): None

G. Required Monitoring: None

H. Acceptance Criteria (referenced by function or mode ID): Provided in footnote to test table above.

1. Sampling Strategy for Identical Units: Described in test table above.

END OF REQUIREMENTS FOR TAB TEST

3.13 LIGHTING CONTROL SYSTEM TEST REQUIREMENTS

A. Parties Responsible to Execute Functional Test:

1. Electrical Contractor
2. Electrical control system manufacturers' rep (if applicable)
3. CA: To witness, direct and document testing

B. Integral Components or Related Equipment Being Tested: Prefunctional tests must be complete for all of the components listed below prior to performing this functional test.

1. Occupancy sensors for lighting
2. Light Timer control panel

C. Prerequisites:

1. The applicable prerequisite checklist items listed in Part 1 of this section and paragraph B above shall be listed on each functional test form and checked off prior to functional testing. The commissioning agent will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

D. Functions/Modes Required To Be Tested, Test Methods:

1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Specification.

| Function / Mode | Test Method Manual, Monitoring, Either or Both | Required Seasonal Test |
|---|---|---|
| General<br>1. Test all manual controls individually. | Manual | |
| 2. Demonstrate all automatic functions using manual control overrides. | | |
| 3. Demonstrate all interlocking functions, i.e., security/fire alarm. | | |

E. Acceptance Criteria

1. Acceptance is achieved when all functions of the specified system have been demonstrated.
2. Verify that minimum specified light levels are maintained under all conditions.

F. Sample strategy for identical units: Demonstrate a random sample of 25% of each type of installation.

END OF REQUIREMENTS FOR LIGHTING CONTROL SYSTEM TEST

## 3.14 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in the *Specifications*. Below is a list of all the formal written work products and who is responsible to create them. In summary, the written products are:

| Product | | Developed By |
|---|---|---|
| 1. | Meeting minutes | CA |
| 2. | Commissioning schedules | CA with CM |
| 3. | Equipment documentation submittals | Subs |
| 4. | Sequence clarifications | Subs and A/E as needed |
| 5. | Prefunctional checklists | Subs |
| 6. | Startup and initial checkout plan | Subs |
| 7. | Prefunctional documentation checklists | Subs |
| 8. | Final TAB report | TAB |
| 9. | Deficiency reports | CA |
| 10. | Preliminary commissioning report | CA |
| 11. | Functional tests | CA |
| 12. | Final Commissioning Report | CA |

- END OF SECTION -

# SECTION 02 10 00

# TREE PROTECTION AND TRIMMING

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 WORK INCLUDED

A. This section includes the protection and trimming of trees that are to remain but interfere with, or are affected by, execution of the Work, whether temporary or new construction.

### 1.3 RELATED SECTIONS

Section 31 11 00: Clearing and Grubbing.
Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 31 25 00: Sediment and Erosion Control.
Section 32 91 13: Soil Preparation and Soil Mixes.
Section 32 92 00: Lawns.

### 1.4 QUALITY ASSURANCE

A. Tree Pruning Standards: Comply with the National Arborist Association's "Pruning Standards for Shade Trees" except where more stringent requirements are indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D448, size 24, with 90 to 100 percent passing a 2½ inch (63-mm) sieve and not more than 10 percent passing a 3/4 inch (19-mm) sieve.

B. Topsoil: As per Specification Section 32 91 13: Soil Preparation and Soil Mixes.

C. Filter Fabric: Manufacturer’s standard, non-woven, pervious, geotextile fabric of

polypropylene, nylon, or polyester fibers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Temporary Protection: Provide temporary fencing, barricades, or other suitable guards located outside the drip line (outer perimeter of branches) to protect remaining trees and other plants from damage.

B. Protect tree root systems from damage due to noxious materials caused by run-off or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line, and prevent soil compaction over root systems.

D. Do not allow fires.

### 3.2 EXCAVATION

A. Install shoring or other protecting support systems to minimize sloping or benching of excavations.

B. Do not excavate within tree drip line, unless otherwise indicated.

C. Where excavation for new construction is required within tree drip lines, hand excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Relocate roots in backfill areas wherever possible. If encountering large, main lateral roots, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches (75 mm) back from new construction.
2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition and temporarily support and protect roots from damage until they are permanently relocated and covered with earth.

D. Where utilities trenches are required within tree drip lines, tunnel under or around

the roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots to tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree drip line. Maintain existing grades within tree drip lines.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots to tap roots; cut only smaller roots. Cut roots cleanly with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade shown, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

C. Moderate Fill: Where existing grade is more than 6 inches (150 mm) but less than 12 inches (300 mm) below finish grade elevation, place a layer of drainage fill, filter fabric, and a final layer of topsoil on existing grade.

1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above finish grade elevation and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip line perimeter, place drainage fill to an elevation 6 inches (150 mm) below grade.
2. Place filter fabric with overlapping edges of 6 inches (150 mm) minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. If required, prune remaining trees to compensate for root loss caused by damaging or cutting root system as directed by the Engineer in accordance with accepted horticultural practices.

B. Cut branches with sharp pruning instruments; do not break or chop.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations to prevent progressive deterioration.

1. Provide new trees of size and species selected by the Engineer when trees over 6 inches (150 mm) in caliper, measured 12 inches (300 mm) above grade, are required to be replaced, due to abuse/damage/neglect of contractor.

## 3.6 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION 02 10 00

# SECTION 02 21 13

# SITE SURVEY

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of 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. Layout for all site work performed by a licensed surveyor.
2. Maintaining site control.
3. Preparing record drawings showing all new utilities and building additions.
4. Locate property and/or easement lines, building or other facilities that could affect construction.

1.3 DEFINITIONS

A. Licensed Surveyor: Registered in state where project is located and accepted by the Owner's Representative.

1.4 SUBMITTALS

A. Copies of the following will be made available to the Owner's Representative upon request throughout the project. Give the original to the Owner for his permanent files no later than two weeks after Contract completion.

1. Establish, maintain, and have available for review by the Owner's representative, throughout term of Contract, legible, comprehensive and complete survey notes, computations, sketches, drawings and similar records kept in a conventional format that is acceptable to the Owner's representative.
2. Record Plans or As Builts of all site improvements performed under this Contract. Using the same design system(s), the level accuracy of Record Plans or As Builts will be equal to that intended on design plans. All data on design plans will be verified or changed to reflect As Built conditions.
3. All calculations and field notes required to reestablish or modify the original control.

1.5 QUALITY ASSURANCE

A. All survey calculations of field work, where the accuracy could affect construction or the original design intent, shall be performed under the supervision of a Surveyor licensed in the state of the project. If requested by the Owner's representative, the Contractor shall have the portion of survey in question certified that the work was done under the supervision of a licensed Surveyor in the applicable state.

B. Perform survey work in accordance with recognized professional surveying practices, complying with local and state laws, rules and regulations. Ensure work performed by qualified personnel acceptable to Owner's representative.

C. Maintain Project Survey field work in a condition such that it can be checked by the Owner's representative, and provide assistance in carrying out these checks. Checking by the Owner's representative does not relieve the responsibilities of this Contract.

1.6 PROJECT CONDITIONS

A. No protected areas, site improvements, off-site areas or any areas to remain will be permanently marked or damaged without written consent of the Owner's representative.

B. All stake-out placed for installation of or performance of site improvements will be maintained in a manner to allow the Owner's representative to perform construction observation.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Surveying instruments and equipment used in performing the Project Survey shall be of the type(s) appropriate for the application at hand and shall be kept in acceptable calibration and good working order.

2.2 MATERIALS

A. All temporary materials used in field shall be weather resistant and of standard quality.

B. All permanent materials incorporated into the project shall be a type that prevents movement from freeze-thaw, minor contact or other expected occurrences and is found to be acceptable by the Owner's representative and local or state authority.

When possible, use material specified on the Drawings.

## PART 3 - EXECUTION

### 3.1 FIELD

A. All survey layout work shall be tied or referenced to the control survey data shown on the plans or supplied by the Engineer. The existing control shall be maintained in its original condition throughout the term of the Contract. If alteration of the original baseline condition is unavoidable, notify the Engineer of this situation and present a plan and procedure to the Engineer for review to remedy this alteration. Bring any error, apparent discrepancy in or absence of control survey data provided, to the Owner's representative's attention for resolution.

B. At the direction of the Owner, establish, stake and reference all rights-of-way, easement limits, and building corners, and where required, stake under the direction of a licensed Land Surveyor. The licensed Land Surveyor shall, through the Contractor, present to the Engineer a certificate with the professional's seal in an acceptable format that such information has been accomplished under his or her direction.

C. At all times maintain the project survey field work in a condition such that it can be reviewed by the Engineer, and render reasonable assistance to the Engineer in carrying out such checks. However, reviewing by the Engineer does not relieve the Contractor of his responsibilities under this Item.

D. Assume sole responsibility for obtaining right of entry to properties, other than those properties on which the Owner has obtained easements with surface rights, for the purpose of conducting layout and survey work.

### 3.2 RECORD DRAWINGS/AS BUILT DRAWINGS

A. Upon completion of the work under this Item, present a certificate to the Engineer attached to the As-built drawings, stating that all of the facilities shown on the Drawings or as may be added, deleted, or altered upon review of the Engineer, have been located in accordance with such Drawings or approved modifications thereof.

END OF SECTION 02 21 13

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# SECTION 02 30 00

# SOIL TESTING SERVICES

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. Related Work Specified Elsewhere:

Section 31 23 00: Earthwork.
Section 31 22 13: Rough Grading.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 32 10 00: Roadway and Miscellaneous Subbase.
Section 32 91 13: Soil Preparation and Soil Mixes.

### 1.2 QUALITY ASSURANCE

A. Laboratory services are solely an assurance that contract provisions are met.

B. Forward copies of test results to Architect, Owner, Construction Manager, and Owner's Representatives within ten (10) days.

C. Testing Agency/Testing Laboratory Qualifications:

1. Agencies shall have not less than five (5) years experience in testing services required on comparable construction projects.
2. Soil testing agency shall be an established geotechnical firm with a Geotechnical Engineer on staff that is licensed in the State of New York. The Contractor shall provide the firm with a copy of the contract drawings and specifications in order that the firm may be able to become thoroughly familiar with the project requirements prior to commencing site inspection and testing services.

## PART 2 - PRODUCTS (Not used)

## PART 3 - EXECUTION

### 3.1 TESTING LABORATORY SERVICES

A. The Contractor, at his own expense, shall obtain the testing services of a geotechnical engineering and testing firm that is regularly engaged in the testing of construction materials.

### 3.2 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

A. To facilitate testing services, the Contractor shall:

1. Furnish to the Testing Agency laboratory such samples of materials as may be necessary for testing purposes.
2. Furnish such casual labor, equipment, and facilities as is necessary to obtain and handle samples at the project.
3. Advise the Testing Agency sufficiently in advance of operations to allow for completion of tests and for the assignment of personnel.
4. Provide safe access to items to be tested. This includes sheeting and ladders for deep excavations.

B. If any portion of the work shows low test results or evidence of detrimental placing, the Owner / Engineer may require additional testing, compaction, or removal and replacement of soil materials at the Contractor's expense. In no case shall the inspector prescribe the method of repair of the defect.

### 3.3 QUALITY CONTROL

A. Testing Agency shall perform the following tests and inspections:

1. Subgrades, Fill and Compaction:

a. Inspection of proofrolling operations including specifying undercuts as necessary. Undercuts shall be at Contractor's expense.
b. Inspection of subgrades upon which select fill, porous fill, subbases at concrete and asphaltic pavements or foundations are to be placed. Verification shall be made by the Testing Agency that all deleterious fill materials have been removed in accordance with the specifications.
c. Sieve analysis of proposed fill materials. Minimum one test for each 1,000 cubic yards of imported materials delivered to site.
d. Optimum moisture - maximum density curve for each soil used for backfill in accordance with ASTM D1557, Method A.

e. Tests in accordance with ASTM D-1577 of actual in-place density for each strata placed.

3.4 FREQUENCY OF TESTING

A. The frequency of in-place density testing per lift of compacted material shall be in accordance with the following table. Minimums apply when areas to be tested are less than the designated unit.

| | NO. OF TESTS | PER UNIT | MINIMUM NO. OF TESTS PER LIFT |
|---|---|---|---|
| Trenches (includes per LF of large diameter underground storage pipe) | 1 | 200 L.F. | 2<br>For Each Type, Run or Size |
| Sidewalks | 1 | 1,000 S.F. | 5 |
| Parking Areas | 1 | 5,000 S.F. | 8<br>For Each Separate Area |
| Roadways (Up to 30' Nominal Width) | 1 | 200 L.F. | 5 |
| Building Slabs | 1 | 1,000 S.F. | 5 |
| Footings and Piers | 1 | 100 L.F. or Pier | 2 for Footings, 1 Per Pier |
| Detention Basin | 1 | 200 C.Y. | 2 |
| Embankment or Subgrade | 1 | 2,000 L.F. | 5 |

B. Frequency of testing may be increased at the discretion of the Owner, Engineer, Architect, or Construction Manager. Additional testing of re-compacted soils shall be at the expense of the Contractor.

END OF SECTION 02 30 00

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SECTION 02 41 22

UTILITY ABANDONMENT

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers the abandonment, demolition/removal, cutting/capping/plugging, termination and discontinuance of existing utilities within the Limits of Work as designated on the Contract Drawings and described herein, including: sewer, water, gas, telephone, cable, and electrical utilities. The Contractor shall protect the active gravity sewer and associated manholes, and active overhead telecom wires and associated utility poles, as shown on the Drawings. See the Contract Drawings for additional information.

B. The locations of existing underground services and utilities shown on the Contract Drawings are based on available records. It is not warranted that all existing utilities and services are shown, or that shown locations are correct. The Contractor shall be responsible for determining the location of existing utilities and having the utility companies locate their respective utilities on the ground prior to excavating. The Contractor shall coordinate utility termination work with the applicable utility companies to ensure services have been shutoff.

C. The Contractor shall furnish all materials, tools, labor, and equipment to abandon, cut/cap/plug, terminate, and discontinue existing utilities as specified herein.

D. Except where specifically noted otherwise, the Contractor shall protect the existing stormwater collection system (catchbasins, drain manholes, piping, and culverts), hydrants, active water mains, active sewer utilities, select utility poles designated to remain for cable/telephone services, and remaining utilities not designated for removal.

E. Except where specifically noted, fire hydrants shall at all times be left clear of obstructions and readily accessible to fire apparatus, and no material or other obstructions shall be placed within ten (10) feet of a fire hydrant.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. The Contractor shall submit a Utility Abandonment Plan to the Engineer within 14 days of the Notice to Proceed. The Utility Abandonment Plan shall include, but not limited to the following: material specifications and shop drawings for all materials and equipment for abandoning existing utilities under this Section and the Contract Drawings; details/plan for protecting utilities to be left in place and details/plan for cutting, capping, abandoning, demolishing, and removing utilities.

B. Submit to the Engineer an As-Built Documents showing locations of all utility cuts/caps/abandonment/demolition locations with Global Positioning System (GPS) coordinates. The Contractor shall also indicate vertical location based on depth from

existing grade. The As-Built Documents will serve as Owner's record of utility termination locations. Utility terminations to be shown with GPS coordinates on the as-built documents include all cut and capped utility services.

## PART 2 - PRODUCTS

### 2.01 CAPPING MATERIALS:

A. Cast Iron/Ductile Iron Piping - Caps shall be ductile iron and mechanical jointed with individually actuated wedges of same diameter of pipe. Caps are to be "Megalug" as manufactured by EBAA Iron Sales, Inc. or approved equal. Provide concrete thrust blocks.

B. Asbestos-Concrete Piping –Capping shall be done by installing a transition coupling, a ductile iron nipple and a mechanical joint cap with retainer gland. Provide concrete thrust blocks.

C. Sanitary Sewer - Concrete or masonry plugs shall be used.

D. Copper, Iron Piping - Caps or plugs shall be permanent screwed or silver soldered cap fittings. Termination materials shall be of the same materials as the pipe.

E. Hydrant Water Line - Where the water line to the hydrant is cut and capped, the Contractor shall coordinate with the Hopkinton Water Department and, at a minimum, install a transition coupling, a ductile iron nipple, a mechanical joint cap with retainer gland, and provide concrete thrust blocks.

### 2.02 CONCRETE AND MASONRY PLUGS:

A. Plugs installed at the open ends of the pipe to be abandoned shall be 12-inch thick 3,000-psi cement concrete, or 8-inch thick brick masonry as required. The pipes to be abandoned as specified herein and as shown on the Contract Drawings.

B. Precast cement concrete plugs that are used shall meet the requirements for 3,000 psi concrete and shall be free of cracks and spalls. Brick masonry plugs shall be made of brick meeting the requirements of ASTM C32, for grade SS, hard brick.

C. Mortar shall be composed of Portland cement, hydrated lime, and sand and the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as required and may vary from 1:1/4 for dense hard-burned brick to 1:3/4 for softer brick. In general, mortar for grade SS brick shall be mixed in the volume proportions of 1:1/2:4-1/2; Portland cement to hydrated lime to sand. The cement concrete plug shall be covered with non-shrink grout to prevent leakage at the plug.

## PART 3 - EXECUTION

3.01 GENERAL:

A. The Contractor shall determine the location of existing utilities to be abandoned from the Contract Drawings, field investigations, electronic utility detectors, coordination with applicable utility companies, and test pits.

B. The Contractor shall at least 72 hours, exclusive of Saturdays, Sundays, and holidays, prior to excavation contact DIGSAFELY before working below ground and shall maintain the DIGSAFELY numbers throughout the course of the project.

C. The Contractor may not begin excavations until approval of the Utility Abandonment Plan. Before backfilling any underground utility termination, the Contractor shall notify the Engineer so the Engineer can inspect and photograph the termination. If the area is covered prior to inspection/approval the work shall be uncovered for inspection at the Contractor's expense. Any and all costs associated with uncovering the work and damages resulting from such uncovering are the sole responsibility of the Contractor. Immediately following the Engineer's inspection/approval, excavations for utility cutting/capping/ abandonment shall be backfilled and the surface restored and maintained in a manner satisfactory to the Engineer.

D. The Contractor shall abandon, demolish/remove, cut/cap/plug, terminate, and discontinue individual building utility services as designated on the Contract Drawings and described in these Specifications. Except where specifically noted otherwise, the Contractor shall protect the existing stormwater collection system (catchbasins, drain manholes, piping, and culverts), monitoring wells and hydrants as designated on the Contract Drawings and described in these Specifications.

E. All utility shut offs shall be coordinated with Owner and applicable utility company. The Contractor shall be responsible for any fees associated with the shut off of utilities. The Contractor shall obtain written authorization from the utility companies before shutting off or terminating any utility service, including terminating water and sewer service.

F. The Contractor shall cut, cap, and remove all utilities within 10-feet of each building scheduled for demolition, unless otherwise specified or noted on the Drawings.

G. The Contractor shall provide detectable tracer tape and an oak marker stake above the plugged end of each utility pipe/conduit to be cut and capped.

3.02 UTILITY ABANDONMENT:

A. Sanitary Sewer System:

1. Existing sewers or drains shall be plugged with 3,000 psi concrete or with brick masonry, as required by the Engineer, 10-feet from the building footprints. The Contractor shall remove and dispose of pipe from the building to the plug

2. For non-circular pipes, the largest interior cross sectional dimension shall govern in determining size of abandonment.

3. The Contractor shall patch any pavement damaged or removed during demolition/capping operations.

4. Plugs shall be of adequate strength to withstand the full soil and groundwater pressure but not less than 5 psi. Plugs and caps shall be watertight.

5. Open ends of sewer services less than 12 inches in diameter shall be plugged with the appropriate PVC, VC, or concrete plugs as required by the Engineer. Such plug shall be made watertight with an application around the plug of an approved watertight compound.

6. Masonry plugs shall be at least 8-inches thick and concrete plugs shall be at least 12-inches thick. Pipes entering a manhole or catch basin that are to be abandoned shall have a plug installed that is flush with the interior wall of the structure.

7. Existing sewers 12-inches and larger shall be abandoned and filled with clean fill, or controlled density fill, and plugged. Existing sewers smaller than 12-inches shall be plugged and abandoned but need not be filled with clean fill or any other material unless otherwise specified by the Engineer. The method of filling the abandoned pipeline shall fill a minimum of 95 percent of the total annular volume of the pipe.

8. The Contractor shall protect active sewer lines. The Contractor shall coordinate with the Owner and the Village of Rye Brook to verify active lines.

B. Water Services:

1. All water mains to be abandoned shall be cut and capped 10-feet from the building footprint and physically removed to the cap.

2. Sections of water mains that are not removed shall have open ends plugged with concrete or brick and mortar to prevent the entrance of soil into the pipe after backfilling.

3. Any water main to be abandoned shall be cut at its connection to a live main and physically disconnected. A watertight ductile iron cap with concrete backing shall be installed on the live main. If a gate valve or corporation stop exists at the connection, it shall be closed.

4. Valve boxes shall be removed from all valves and curb stops which are on the abandoned main.

C. Electrical Service:

1. The disconnection of electrical utilities to be done by others. Scheduling of disconnection will require coordination between Contractor, Electric Company and Owner.

2. The Contractor will arrange to have the electrical services terminated at main utility poles. The Contractor shall remove and dispose of all wire and electrical appurtenances that are abandoned. The Contractor shall <u>not</u> remove any transformers or any active utility poles. The Contractor shall coordinate with Owner and Electric Company before handling any utility poles, electrical wiring, and appurtenances.

D. Gas Service:

1. The Contractor will arrange to have the gas company disconnect gas service to the buildings and remove exterior gas appurtenances. The Gas Company shall remove individual gas services to the building. The Contractor shall coordinate the abandonment of gas utilities with Gas Company and Owner to assure that the gas has been disconnected. The Contractor is responsible for the protection of gas mains during the demolition work, and ensuring that the connections to the building has been removed and plugged at the main by the Gas Company. The Contractor shall remove and dispose of all interior gas piping and appurtenances, and all appurtenances remaining outside the building. The Contractor shall also remove remaining above grade gas piping to the point where the piping turns horizontal underground, as applicable.

E. Telephone:

1. The Contractor shall arrange with the telephone provider to have telephone services to the building disconnected at the pole. The Contractor shall remove and dispose of all abandoned wiring and appurtenances. The Contractor shall coordinate with Owner before arranging to have telephone service disconnected. Telephone services and associated utility poles that are designated to remain active shall be protected.

F. Cable:

1. The Contractor shall arrange with the cable provider to have cable services to the building disconnected at the pole. The Contractor shall remove and dispose of all abandoned cable wiring and appurtenances. The Contractor shall coordinate with Owner before arranging to have cable services disconnected. Cable services and associated utility poles that are designated to remain active shall be protected

G. Building Drain Connections

1. The Contractor shall plug and remove drains from the buildings (roof drains, floor drains, etc.) per applicable regulations and, at a minimum, 10-feet from the building

footprint with high-strength non-shrink cement grout and brick and mortar plugs at the end of the pipe where shown in Contract Drawings. The Contractor shall remove and dispose of pipe from the building to the plug. Any AC pipe shall be capped as specified in Paragraph 2.01 of this Section and per applicable state and federal regulations.

3.03 CONCRETE PLACING DURING COLD WEATHER:

A. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when temperature is below 40ºF, or is expected to fall to below 40ºF, within 73 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval of the Engineer. All procedures shall be in accordance with provisions of ACI 306.

3.04 CONCRETE PLACING DURING HOT WEATHER:

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing, shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays, which will result in excessive mixing of the concrete after arrival on the job.

B. During periods of excessively hot weather (90ºF or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90ºF, when ready for placement, will not be acceptable, and will be rejected.

END OF SECTION

SECTION 03 05 00

FIELD CONCRETE

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers concrete and all related items necessary to place and finish the concrete work.

B. Concrete thrust, and anchor blocks, to be provided at all water main bends, tees, plugs and wyes and at other locations required by the Engineer shall be installed in accordance with the details shown on the drawings and as specified in this section.

C. Concrete encasement for piping with shallow cover and for encasement of telephone, and electrical duct bank when specified shall be installed in accordance with the details shown on the drawings and as specified in this section.

1.02 RELATED WORK:

A. Section 31 00 00, EARTHWORK

B. Section 33 11 13.13, DUCTILE IRON PIPE AND FITTINGS

1.03 REFERENCES:

A. The following standards form a part of this specification:

American Concrete Institute (ACI)

ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

ACI 305 Recommended Practice for Hot Weather Concreting

ACI 306 Recommended Practice for Cold Weather Concreting

ACI SP-66 ACI Detailing Manual

ACI 318 Building Code Requirements for Reinforced Concrete

American Society for Testing and Materials (ASTM)

ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C33 Concrete Aggregates

ASTM C94 Ready-Mixed Concrete

ASTM C143 Test for Slump of Portland Cement Concrete

ASTM C150 Portland Cement

ASTM C260 Air Entraining Admixtures for Concrete

ASTM C494 Chemical Admixtures for Concrete

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six copies of the statement of materials constituting the design of mixes for each size aggregate as required by ASTM C94 shall be submitted to the Engineer within one week following award of the Contract.

PART 2 - PRODUCTS

2.01 CONCRETE:

A. All concrete, reinforced or non-reinforced shall have a 28-day compressive strength of 3300 psi unless otherwise noted on the design drawings. A minimum of 5.5 sacks of cement per cubic yard and a maximum water cement ratio of 6.9 gallons per sack shall be used.

B. Concrete shall conform to ASTM C94. The Contractor shall be responsible for the design of the concrete mixtures. Slump shall be a maximum of 4-inches and a minimum of 2-inches, determined in accordance with ASTM C143.

C. Admixtures shall be as specified in subsection 2.05. No additional admixtures shall be used unless approved by the Engineer.

D. No additional water, except for the amount indicated by the design mix shall be added to the concrete without the prior permission of the Engineer.

2.02 REINFORCING:
Reinforcing as shown on the plans or as required by the Engineer, shall conform to ACI 318 and ASTM A615 and shall be detailed in accordance with ACI SP-66. All Steel reinforcing bars shall be grade 60.

2.03 CEMENT:

The cement shall be an approved brand of American manufactured Portland Cement, Type II conforming to the applicable requirements of ASTM C150.

2.04 AGGREGATES

A. Except as otherwise noted, aggregate shall conform to the requirements of ASTM C33.

B. Maximum size aggregate shall be 3/4-inch.

2.05 ADMIXTURES:

A. All concrete (unless otherwise directed) shall contain an air entraining agent. Air entrained concrete shall have air content by volume of 4 to 8 percent for 3/4-inch aggregate.

B. Air entraining agent shall be in accordance with ASTM C260 and shall be Darex AEA, as manufactured by W.R. Grace & Company; Placewel (air entraining Type), as manufactured by Johns Manville; Sika AER as manufactured by Sika Chemical Company; or an approved equal product.

C. Water reducing agent shall be WRDA, as manufactured by W.R Grace & Company; Placewel (non-air entraining Type), as manufactured by Johns Manville; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.

D. Water reducing agent-retarder shall be "Daratard," as manufactured by W.R. Grace & Company; Sika Plastiment as manufactured by Sika Chemical Company; or an approved equal product.

2.06 WATER:

A. Water for concrete shall be potable, free of deleterious amounts of oil, acid, alkali, organic matter and other deleterious substances.

2.07 CONCRETE FORMS:

A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Engineer.

B. Form ties shall be cone type or equal, with waterstop, which leaves no metal closer than 2-inches to finished face of concrete.

C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.

D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete

PART 3 - EXECUTION

3.01 PREPARATION:

A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint or the material which would tend to reduce the bond.

B. Earth, concrete, masonry, or other water permeable material against which concrete is to be placed shall be thoroughly saturated with water immediately before concrete is placed.

C. No concrete shall be placed until the consolidation of the ground and the arrangement and details of forms and reinforcing have been inspected and approved by the Engineer.

3.02 THRUST AND ANCHOR BLOCKS:

A. Minimum bearing areas for thrust blocks and dimensions of anchor blocks shall be as shown on the drawings.

B. Concrete for thrust and anchor blocks shall be placed against undisturbed earth, and wooden side forms shall be used to provide satisfactory lines and dimensions. Felt roofing paper shall be placed to protect joints. No concrete shall be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints.

3.03 FILL CONCRETE:

A. Fill concrete shall be placed in those locations as indicated on the design drawings. Fill concrete shall consist of materials as previously specified, with a minimum 28-day compressive strength of 3000 psi.

B. Before fill concrete is placed, the following procedures shall be used to prepare surfaces; all dirt, scum and laitance shall be removed by chipping and washing. The clean, roughened base surface shall be saturated with water, but shall have no free water on the surface. A coat of 1:2 cement-sand grout, approximately 1/8-inch thick, shall be well scrubbed into the thoroughly dampened concrete base. The concrete fill shall be placed immediately, before grout has dried or set.

C. Fill concrete shall be brought to lines and grades as shown on the design drawings.

3.04 CONCRETE PLACING DURING COLD WEATHER:

A. Concrete shall not be placed on frozen ground, and no frozen material or material containing ice shall be used. Materials for concrete shall be heated when temperature is below 40ºF, or is expected to fall to below 40ºF, within 73 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. All details of Contractor's handling and protecting of concrete during freezing weather shall be subject to the approval of the Engineer. All procedures shall be in accordance with provisions of ACI 306.

3.05 CONCRETE PLACING DURING HOT WEATHER:

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing, shall be sprinkled with cold water. The Contractor shall make every effort to minimize delays, which will result in excessive mixing of the concrete after arrival on the job.

B. During periods of excessively hot weather (90°F or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 90°F, when ready for placement, will not be acceptable, and will be rejected.

3.06 FIELD QUALITY CONTROL:

A. Concrete inspection and testing shall be performed by the Engineer or by an inspection laboratory, designated by the Engineer, engaged and paid for by the Owner. Testing equipment shall be supplied by the laboratory, and the preparation of samples and all testing shall be performed by the laboratory personnel. Full assistance and cooperation, concrete for samples, and such auxiliary personnel and equipment as needed shall be provided by the Contractor.

B. At least 4 standard compression test cylinders shall be made and tested and 1 slump test from each day's placement of concrete. A minimum of four compression test cylinders shall be made and tested for each 100 cubic yards of each type and design strength of concrete placed. One cylinder shall be tested at 7 days, and two at 28 days. The fourth cylinder from each set shall be kept until the 28 day test report on the second and third cylinders in the same set has been received. If the average compressive strength of the two 28 day cylinders do not achieve the required level, the Engineer may elect to test the fourth cylinder immediately or test it after 56 days. If job experience indicates additional cylinder tests or other tests are required for proper control or determination of concrete quality, such tests shall be made.

C. The Engineer shall have the right to reject concrete represented by low strength tests. Rejected concrete shall be promptly removed and replaced with concrete conforming to the specification. The decision of the Engineer as to whether substandard concrete is to be accepted or rejected shall be final.

END OF SECTION

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SECTION 03 05 10

CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE

PART 1 - GENERAL

1.01 SUMMARY:

A. Furnish the following items for installation under related sections:

1. High performance, concrete moisture vapor reduction admixture (MVRA) for all new concrete slabs on grade, elevated slabs, and stair treads and landings under Section 03 30 00 - CAST-IN-PLACE CONCRETE that will receive flooring.

1.02 RELATED REQUIREMENTS:

A. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Cast-in-place concrete materials and placement, and vapor retarder.

B. Section 09 67 23 – RESINOUS FLOORING: Flooring materials installed over concrete slabs that contain integral waterproofing and for preparation requirements.

1.03 DEFINITIONS:

A. Cementitious Materials: Portland cement alone or in combination with any of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast- furnace slag, and silica fume; subject to compliance with requirements.

1.04 REFERENCES:

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM D 5084: Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
2. ASTM E 1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
3. ASTM E 1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
4. ASTM F 710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM C 494/C 494M-08a Chemical Admixtures for Concrete Type S.

1.05 SUBMITTALS:

A. Submit the following under provisions of Section 01 33 00 - SUBMITTALS:

1. Product Data: Manufacturer's printed data sheets.
   a. Include standard slab repair details.
   b. Include vapor barrier data showing compliance with this section.
2. Product test reports performed by a qualified independent testing agency evidencing compliance of products with specified requirements of water-vapor transmission based on comprehensive testing of current products.
3. Manufacturer's certificate certifying admixture provided meets or exceeds specified requirements.
4. Sample warranty, including adhesion guarantee and moisture letter.

1.06 QUALITY ASSURANCE:

A. Manufacturer Qualifications: A firm with not less than ten (10) years' experience in the manufacture of the specified concrete moisture vapor reduction admixture, capable of providing test reports indicating compliance with specified performance requirements, and able to provide on-site technical representation should the need arise. Selected product must have certification of compliance with ASTM C494 /C494M testing protocols from an independent AASHTO approved laboratory.

B. Pre-installation Conference:

1. Verify MVRA project specific quality control procedures, review concrete mix designs and examine procedures for ensuring quality of concrete materials. Each entity directly concerned with MVRA dosed concrete must attend in person, conference call, or provide electronic review of documents, mix designs and procedures. Those required to participate or to review include but are not limited to:
   a. Contractor.
   b. Independent testing agency responsible for concrete design mixtures, sampling and testing.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Moisture Vapor Reduction Admixture manufacturer.

C. Moisture Vapor Reduction Admixture Collection Agent / Representative Qualifications

1. Personnel conducting field sampling on behalf of the MVRA manufacturer shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Quality Control Protocol shall consist of the concrete water vapor transmission inhibiting admixture representative procuring two random cylinders from every placement of concrete containing the concrete water vapor transmission inhibiting

admixture. These cylinders shall be sent to an independent laboratory for hydraulic conductivity (coefficient of permeability) testing per ASTM D 5084. The results of this "project specific" quality control protocol shall form the basis for the issuance of the project specific warranty.

1. Should the Quality Control Protocol deliver results in excess of 6.0 E-08 cm/sec, the concrete water vapor transmission inhibiting admixture manufacturer shall provide, at their expense, an epoxy topical moisture mitigation system for all areas not meeting the stated limit.
   a. The moisture mitigation system shall include all labor and material for slab profiling, epoxy material, and application.
   b. The moisture mitigation system shall include a warranty meeting or exceeding the terms of the manufacturer's warranty specified in this Section.

E. Toxicity/Hazardous Materials: Provide products that contain no urea-formaldehyde.

F. Repairs to slabs must be in accordance with concrete industry standards and meeting waterproofing admixture manufacturer's published details.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Comply with manufacturers written instructions for handling prior to adding to concrete batch.

B. Store both components protected from exposure to harmful weather conditions and in a temperature controlled area above 36 degrees F. Do not allow product to freeze.

1.08 WARRANTY:

A. Special Warranty: Provide manufacturer's standard warranty documents executed by an authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the owner may have under provisions of the Contract Documents.

1. Warranty Period: Life of the concrete.
   a. Warranty requirements: Said product must be installed according to and in compliance with the manufacturer's published data sheet to include but not limited to dosing instructions, onsite representation requirements, and the use of an ASTM E 1745 vapor retarder, installed following ASTM E 1643 and ASTM F 710 guidelines; elevated concrete slabs do not require a vapor retarder.
      1) Repair and/or removal of failed flooring.
      2) Placement of a topical moisture remediation system.
      3) Replacement of flooring materials like original installed to include material and labor.
      4) MVRA manufacturer shall provide an adhesion warranty to match the term of the adhesive manufacturer's warranty in accordance with the MVRA manufacturer's requirements for conveyance of such.

2. Warranty Basis: Follow Quality Control Protocol specified in this Section, achieving a maximum coefficient of permeability of 6.0 E-08 cm/sec on all project test samples.

PART 2 - PRODUCTS

2.01 CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE:

A. Concrete Moisture Vapor Reduction Admixture (MVRA): Concrete moisture vapor reduction admixture for all interior slabs on grade shall be a non-toxic, liquid admixture that is specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through the slab by restricting the integral capillary system. The chemical reaction forms a permanent barrier (capillary break) that is integral to the concrete, insoluble and irremovable.

1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on ISE Logik Industries, Gulfport, MS, product "MVRA 900".
2. Provide the above-named product or approved equal upon receipt of approval from the Engineer, provide a product that meets or exceeds the following project specific performance requirements at the expense of the concrete moisture vapor reduction admixture (MVRA) manufacturer:

B. Project specific quality control process to include, but not be limited to:

1. Independent procurement of one cylinder per day of placement of concrete containing MVRA.
2. Independent testing of all cylinders for hydraulic conductivity per ASTM D 5084.
3. Assessing each cylinder for maximum flow of 6.0 E-08 cm/sec.
4. Should any cylinder exceed the maximum flow, procure a core from that day's placement.
5. Independently test core for hydraulic conductivity per ASTM D 5084.
6. Should any core exceed the maximum flow, provide a topical moisture mitigation system for all areas not meeting the stated limit; moisture mitigation system to include all labor, material and warranty that meets or exceeds the terms of the concrete moisture vapor reduction admixture manufacturer's warranty.

2.02 MATERIALS:

A. Concrete Water Vapor Transmission Inhibiting Admixture: Non-toxic, liquid admixture for concrete that reacts with water and portlandite filling the capillary system with calcium silicate hydrate (CSH) to eliminate the route for moisture migration. Once the admixture is added to the mix design, the admixture shall react with the water to allow the concrete to be flexible, even at low slump.

1. Product Description: Concrete water vapor transmission inhibiting admixture shall

be a complex formula that is free of all volatile organic compounds (VOC). It shall be specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through concrete by closing down the integral capillary system. The chemical reaction shall form a permanent barrier (capillary break) which is integral to the concrete and irremovable.

a. Water Vapor Transmission: 0.20 US perms per ASTM D 5084
b. Appearance: Colorless.
c. Odor: None.
d. Toxicity: None.
e. Flammability: None.
f. Ph: 11.3.
g. Shelf Life: Indefinite.
h. Weight: 11.2 lbs per gallon.
i. Freeze Temp: 32°F.
j. Storage Temp: Above 36°F.
k. Solvent: Water.
l. Acid Resistance: Excellent.
m. Hazardous Vapors: None.
n. Capillary Break: Calcium Silicate Hydrate Gel.
o. Installation: All concrete.
p. VOC Levels: Zero.

B. Provide manufacturer's standard anti-microbial biocide to inhibit mold and bacteria growth.

2.03 ACCESSORIES:

A. Sheet Vapor Retarder: As specified in Section 07 26 00 – VAPOR RETARDERS. Comply with the following:
   1. 0.01 US perms (grains/ft2*hr*inHg) or less after the required product conditioning specified in ASTM E 1745-09 Include manufacturer's recommended adhesive or pressure-sensitive tape.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Install vapor barrier following ASTM E 1643-98(2005) guidelines and in accordance with Section 03 30 00 - CAST-IN-PLACE CONCRETE.

B. Moisture Vapor Reduction Admixture: Add admixture in accordance with manufacturer's recommendations to all ready-mix concrete, at the batch plant or at the job site.
   1. A representative or agent of the manufacturer must be present at the

jobsite during the placement of all treated concrete. Do not proceed without the representative being present for the certification of the mix and placement process. Provide minimum 10 days notice of the placement of the treated concrete.

2. The Quality Control Protocol for admixture shall consist of the representative procuring two random cylinders from every placement of concrete containing admixture. These cylinders will be sent to an independent laboratory for hydraulic conductivity (coefficient of permeability) per ASTM D5084. The results of this "project specific" quality control protocol forms the basis for the issuance of the project specific warranty.

C. Dispense admixture at a rate of 14 ounces per 100 pounds of cementitious materials at the tail end of the load, dose to be within plus or minus 3 percent. Additional dosage may be required based on the mix design.

1. Add admixture to ready mix concrete truck, in the require dosage, and mix for 7 (seven) minutes before discharge. Admixture is to be used in lieu of designed mix water, not in addition to mix water.
2. Do not alter 0.45 water/cementitious materials ratio without prior approval.
3. The addition of non-chlorinated admixtures is permitted.
4. The addition of Shrink Reducing Admixtures is not permitted.

D. Other admixtures may be used in the same concrete batch provided that such admixtures are added separately.

1. The water-to-cementitious material ratio (w/cm) is critical and it is imperative to comply with the mix design. Admixture shall be used in lieu of that portion of the mix water, not in addition to the mix water.Use of plasticizers or water reducers is recommended to achieve slumps greater than 4 inches.

3.02 CURING:

A. Comply with curing requirements in Section 03 30 00 - CAST-IN-PLACE CONCRETE.

3.03 FIELD QUALITY CONTROL:

A. Testing of Slabs Containing MVRA:

1. The moisture vapor reduction admixture (MVRA) manufacturer will perform all moisture testing in accordance with this specification and will issue project specific warranties and adhesion guarantees prior to installation of any slab finishes; no further field slab moisture nor pH testing shall be required.
   a. Failure to provide a product that meets or exceeds these requirements will result in all subsequent testing and slab remediation costs being borne by the Contractor.
2. A representative or agent of the moisture vapor reduction admixture (MVRA) manufacturer must be present at the jobsite during placement of all MVRA treated concrete.

a. Do not proceed without this representative being present.

b. A minimum of one business day notification is required.

3. Field testing technician shall, at the expense of the MVRA Manufacturer, procure at least one 4 inch cylinder from every day of placement of MVRA dosed concrete for the purpose of subsequent hydraulic conductivity/coefficient of permeability testing.

4. All cylinders shall be independently lab tested in accordance with ASTM D 5084 at the expense of the MVRA manufacturer.

5. Test results must conform to specified limits.

a. Should any cylinder from any day of placement deliver results in excess of 6.0 E- 08 cm/sec, the concrete moisture vapor reduction admixture manufacturer shall procure, at their expense, a core (or cores) from that day of placement. This core (cores) shall be sent to an independent laboratory for hydraulic conductivity (coefficient or permeability) per ASTM D 5084.

b. Should any core deliver results in excess of 6.0 E-08 cm/sec per ASTM D 5084, the concrete moisture vapor reduction admixture manufacturer shall provide, at their expense, a topical moisture mitigation system for all areas not meeting the stated limit.

6. Proceeding with placement of concrete dosed with the MVRA without the required representation will result in the contractor bearing the cost to core and ship appropriate material for testing per ASTM D 5084.

B. Concrete Water Vapor Transmission Inhibiting Tests: If the results of the testing of the original cylinders is inconclusive, additional testing of slabs containing concrete water vapor transmission inhibiting admixture shall be carried out by the concrete water vapor transmission inhibiting admixture manufacturer's technical representative to include: Two random, 4-inch drilled sample cores and/or cylinders on all project slabs.

C. The sample cores and/or cylinders shall be sent to an independent laboratory and tested for permeability in accordance with ASTM D 5084, and shall achieve a minimum 6.0 E-08 cm/sec. The results shall be provided to the Contractor and Engineer prior to the installation of floor coverings and as part of the warranty closeout documents.

1. The manufacturer's warranty must be in place prior to installation of flooring materials.

2. All adhesives used for flooring installation must be compatible with the MVRA and manufactured for non-porous surfaces. Comply with Division 09 Sections for installation.

D. Additional testing may be required in accordance with the water vapor transmission inhibiting admixture manufacturer's requirements. No other testing shall be required for installation of floor coverings.

3.04 REPAIRS:

A. Make repairs to slab in accordance with Section 03 30 00 - CAST-IN-PLACE CONCRETE and as shown in manufacturer's published details and remediation program.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 -GENERAL

1.01 GENERAL PROVISIONS:

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK:

A. Work Included: This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Footings
2. Foundation walls
3. Knee walls
4. Slab-on-grade
5. Suspended slabs
6. Interior equipment (housekeeping) pads and curbs
7. Exterior slabs, including fuel island and sidewalks
8. Mud mats
9. Concrete toppings
10. Grout

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS
2. Section 03 05 10, CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE
3. Section 03 05 13, CONCRETE SEALERS
4. Section 04 20 00, UNIT MASONRY
5. Section 05 31 23, STEEL DECK; Steel composite and form deck.
6. Section 06 10 00, ROUGH CARPENTRY
7. Section 07 26 00, VAPOR RETARDERS
8. Section 13 42 00, PREFABRICATED ENGINEERED BUILDINGSp

9. Section 31 00 00, EARTHWORK; Excavation and establishment of subgrade elevations.

1.03 SUBMITTALS:

A. Refer to Section 01 33 23, SUBMITTALS for submittal provisions and procedures.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, and others if requested by the Engineer or SER.

C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing and supports for concrete.

D. Submit shop drawings for all formwork for Architecturally Exposed Concrete (Concrete Exposed to View) showing cone tie patterns.

E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.

1. Submit alternate mix designs when the characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
2. Indicate the amounts of mixing water to be withheld for later addition at the Project site.

F. Proposed method of curing and associated products.

G. Proposed precautions for hot weather and cold weather concreting.

H. Samples: For waterstops and vapor retarder.

1. Submit samples of materials as requested by the Engineer or SER, including names, sources, and descriptions.

I. Laboratory test reports for concrete materials and mix design test.

J. Material test reports for the following, from a qualified testing agency, indicating compliance with specification requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

K. Material certificates for each of the following, signed by the manufacturers:

1. Cementitious material.
2. Admixtures
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Non-metallic shrinkage resistant grout.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

L. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

M. Qualification Data: For Installer and Manufacturer.

*N.* Minutes of pre-installation conference.

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mix concrete products that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency for Mix Design Qualifications: An independent agency, registered in the State of New York as an approved testing agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. The Testing Agency Laboratory supervisor shall be an ACI certified Concrete Laboratory Testing Technician – Grade II.

D. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications:

1. Comply with the following unless modified by requirements in the Contract Documents:
   a. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
   b. ACI 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."
   c. ACI 214, "Evaluation of Strength Test Results of Concrete."
   d. ACI 301, "Specification for Structural Concrete."
   e. ACI 304, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
   f. ACI 305, "Hot Weather Concreting."
   g. ACI 306, "Cold Weather Concreting."
   h. ACI 308, "Guide to Curing Concrete."
   i. ACI 309, "Guide for Consolidation of Concrete."
   j. ACI 311.1, "ACI Manual of Concrete Inspection."
   k. ACI 315, "Details and Detailing of Concrete Reinforcement."
   l. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
   m. ACI 347, "Guide for Formwork for Concrete."
2. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract.

F. American Society for Testing and Materials (ASTM):

1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

G. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M194 "Chemical Admixtures."

H. Pre-installation Conference: Conduct a conference at the Project site to comply with requirements in Division 1 Section “Project Management and Coordination.”

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete 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 subcontractor.
   e. Structural Engineer.
   f. Independent testing agency responsible for field testing.
   g. Owner’s Authorized Representative.
   h. Engineer.
2. Review inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor slab and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS:

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Formwork for elements exposed to view, including, but not limited to knee walls, above grade piers, and exposed faces of retaining walls, shall conform to Surface Finish 3.0 per ACI 301.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, ¾-inch by ¾-inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral earth pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

G. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.

H. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

D. Reinforcing at the Salt Shed shall be epoxy coated per ASTM A 775 and ASTM A 934.

2.03 NON-METALLIC SHRINKAGE RESISTANT GROUT:

A. 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. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

2.04 REINFORCEMENT ACCESSORIES:

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice", of greater of compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.05 ANCHOR RODS

A. Anchor Rods: ASTM F 1554, Grade 55 (Weldable), Hot Dipped Galvanized per ASTM A 153. Headed type unless otherwise noted. Provide suitable nuts in accordance with ASTM F1554 and ASTM A563 and washers in accordance with ASTM F436. Nuts and washers shall be hot-dipped galvanized.

B. Anchor rod required diameters are as specified by the Prefabricated Engineered Building Manufacturer and approved by the Engineer. Embedment depths are as specified by the Engineer.

2.06 CONCRETE MATERIALS:

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

*B.* Fly Ash: ASTM C 618, Class F.

C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Cementitious Materials: Percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash or Ground Granulated Blast Furnace Slag: 25 percent, minimum.
2. Combined Fly Ash and Pozzolan: 35 percent, maximum.
3. Ground Granulated Blast Furnace Slag: 50 percent, maximum.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 35 percent.

E. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse Aggregate Size: ¾-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94 and potable.

2.07 ADMIXTURES:

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor,; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products:
2. Euclid Chemical Company; Eucon CIA.
3. Grace Construction Products, W.R. Grace & Co.; DCI.

4. BASF Admixtures, Inc.; Rheocrete CNI.
5. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:
   a. Grace Construction Products, W.R. Grace & Co.; DCI-S.
   b. Sika Corporation: Sika FerroGard 903
   c. Euclid Chemical: Eucon BCN

E. Concrete Moisture Vapor Reduction Admixture: Refer to Specification Section 03 05 10.

F. Integral Crystalline Waterproofing Admixture. Incorporate into concrete mix design per the manufacturer's recommendations.

1. Products:
   a. Penetron Admix, Penetron International Ltd.
   b. Xypex Admix C-500, Xypex
   c. Aquafin-IC Admix, Aquafin Inc.

2.08 WATERSTOPS:

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, ¾-inch by 1-inch.

1. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
2. Concrete Sealants, Inc.; Conseal CS-231.
3. Greenstreak; Swellstop.
4. Henry Company, Sealants Division; Hydro-Flex.
5. Progress Unlimited, Inc.; Superstop.
6. TCMiraDRI; Mirastop.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8-inch by ¾-inch.

1. Deneef Construction Chemicals; Swellseal.
2. Greenstreak; Hydrotite.

3. Mitsubishi International Corporation; Adeka Ultra Seal.
4. Progress Unlimited, Inc.; Superstop.

C. Waterstops: Provide ribbed, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated.

1. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

2.09 VAPOR RETARDERS:

A. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:
   a. Fortifiber Corporation; Moistop Ultra.
   b. Raven Industries, Inc.; Vapor Block 10.
   c. Stego Industries, LLC; Stego Wrap, 15 mils.

2.10 FLOOR AND SLAB TREATMENTS:

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.

1. Products:
   a. Burke by Edoco; NonMetallic Floor Hardener.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 500.
   c. Dayton Superior Corporation; Quartz Tuff.
   d. Euclid Chemical Company; Surflex.
   e. Lambert Corporation; Colorhard.
   f. L&M Construction Chemicals, Inc.; Quartzpalte FF.
   g. Scofield, L.M. Company; Lithochrome Color Hardener.
   h. Symons Corporation, a Dayton Superior Company; Hard Top.

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products:
   a. Burke by Edoco; Titan Hard.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.

c. Curecrete Distribution Inc.; Ashford Formula.
d. Dayton Superior Corporation; Day-Chem Sure Hard.
e. Euclid Chemical Company; Euco Diamond Hard.
f. Kaufman Products, Inc.; SureHard.
g. L&M Construction Chemicals, Inc.; Seal Hard.
h. Meadows, W.R., Inc.; Liqui-Hard.
i. Symons Corporation, a Dayton Superior Company; Buff Hard.

2.11 CURING MATERIALS:

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor coverings.

1. Products:
a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
c. Euclid Chemical Company; Diamond Clear VOX.
d. Lambert Corporation; Glazecote Sealer-20.
e. L&M Construction Chemicals, Inc.; Dress & Seal WB.
f. Meadows, W.R., Inc.; Vocomp-20.
g. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
h. Sonneborn, Div. Of ChemRex; Kure-N-Seal.
i. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:
a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.

b. Euclid Chemical Company; Super Diamond Clear VOX.
c. Lambert Corporation; UV Safe Seal.
d. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
e. Meadows, W.R., Inc.; Vocomp-30.
f. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.12 RELATED MATERIALS:

A. Expansion and Isolation Joint Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS:

A. Repair Underlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to ¼-inch or coarse sand as recommended by the underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C 109.

B. Repair Overlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to ¼-inch or coarse sand as recommended by the topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C 109.

2.14 CONCRETE MIXTURES, GENERAL:

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water cementitious materials ratio below 0.50.
4. Use retarding admixture in combination with Set accelerating Corrosion Inhibitor. Retarder is not required for non-set accelerating corrosion inhibitor.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated.
6. Use moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.
7. Use integral crystalline waterproofing admixture in concrete mixtures where indicated.

2.15 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4-inches for concrete with verified slump of 2-inch to 4-inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Corrosion Inhibiting Admixture: Apply to walls and piers at a rate of 3 gallons per cubic yard of concrete.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.4.
3. Slump Limit: 4-inches, plus or minus 1-inch. prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Corrosion Inhibiting Admixture: Apply to all slabs at a rate of 3 gallons per cubic yard of concrete.

C. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4-inches, plus or minus 1-inch. prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.

D. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.

2.16 FABRICATING REINFORCEMENT:

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice".

2.17 CONCRETE MIXING:

A. Ready-Mix Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

B. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing.

3.02 FORMWORK:

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8-inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspections ports where interior area formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.03 EMBEDDED ITEMS:

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use

setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges".
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.04 REMOVING AND REUSING FORMS:

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Engineer.

3.05 VAPOR RETARDERS:

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

B. Lap joints 6-inches and seal with manufacturer's recommended tape.

3.06 STEEL REINFORCEMENT:

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire ties.

3.07 JOINTS:

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2-inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, and girders and at the top of footings and floor slabs.
5. Space vertical joints in walls at 60-feet on center maximum. Locate joints besides piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Terminate full-width joint filler strips not less than ½-inch or more than 1-inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants", are indicated.
2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 CONCRETE PLACEMENT:

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, providing water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing of concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.09 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with minimum number of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS:

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
3. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

D. Broom Finish: Apply a broom finish to exterior platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

E. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to all surfaces with truck traffic according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb. /100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.11 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Curing all slabs in the project with moisture curing. Keep surfaces continually moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12-inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial applications. Maintain continuity of coating and repair damage during curing period.
   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply second coat. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.13 LIQUID FLOOR TREATMENTS:

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment to concrete floors exposed to view according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Comply with Manufacturer's written instructions for application.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING:

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.15 CONCRETE SURFACE REPAIRS:

A. Defective Concrete: repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to the Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush coat holes and voids with bonding agent. Fill and compact patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14-days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least ¾-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate.

Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72-hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to the Engineer's approval.

3.16 FIELD QUALITY CONTROL:

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample of each day's pour of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.
2. Slump: ASTM C 143; 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, pressure method, for normal-weight concrete; 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; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.
6. Cast and laboratory cure five standard cylinder specimens for each composite sample.
7. Compressive Strength Tests: ASTM C 39; test one set of two-laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Test remaining specimen at 28 days if previous results are satisfactory or retain this specimen for 56 day testing if results are not satisfactory.
8. Strength of each concrete mixture will be satisfactory if every 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 the Engineer, 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.

1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as the sole basis for approval or rejection of concrete.
2. 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 required by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as required by the Engineer.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.17 GROUTING:

A. Mix grout in accordance with the approved manufacturer's instructions to a consistency which will permit placement. Place grout so as to ensure complete bearing and elimination of air pockets.

3.18 TEST FOR WATERTIGHTNESS:

A. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Engineer. See Section 03150, WATERSTOPS.

B. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.

C. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Engineer. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.

D. For structures designed to hold water, one twentieth of one percent leakage will be allowed during a 24-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.

E. The Contractor shall pay all costs (including water) incurred in the testing for watertightness.

F. The Engineer shall be given a minimum notice of 48 hours prior to commencement of the leakage test.

END OF SECTION

SECTION 03 35 10

POLISHED CONCRETE FINISHING

## PART 1 - GENERAL

1.01 SUMMARY

A. Provide concrete stain and polishing at all areas scheduled for exposed concrete finish, in two applications. Work includes:

1. Applying sealer, hardener and polishing concrete to specified finish level.
2. Clean and prepare concrete surfaces for second application immediately prior to Owner's acceptance

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE:

1. Placing and finishing concrete slabs.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ACI 302.1R Guide for Concrete Floor and Slab Construction.
2. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.
4. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
5. Rilem Test Method 11.4 Standard Measurement of Reduction of Moisture Penetration Through Horizontal Concrete Surfaces.
6. NFSI Test Method 101-A Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

1.04 PERFORMANCE/DESIGN CRITERIA

A. Provide dyed and polished flooring that has been selected, manufactured and installed to meet the following requirements:

1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch (0.20 mm) wear in 30 minutes.
2. Reflectivity: Increase of 35% as determined by standard gloss meter.

3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
4. High Traction Rating: NFSI 101-A, non-slip properties.

1.05 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
   a. Test reports showing compliance with specified performance characteristics and physical properties.
   b. Preparation and concrete grinding procedures.
   c. Manufacturer’s installation instructions indicating special procedures, and perimeter conditions requiring special attention.
2. Certificates:
   a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
   b. Letter of Certification from the National Floor Safety Institute (NFSI) confirming dye and polishing system has been tested and passed Phase Two Level of Certification when tested by Method 101-A.
   c. Current trade contractor’s certificate signed by manufacturer declaring trade contractor as an approved installer of polishing system.
3. Shop drawings:
   a. 1/4 inch scale plans of typical layout including dimensions, floor grinding schedule, joint pattern layout and areas to receive colored surface treatments.

B. Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT:
1. Manufacturer’s and Applicator’s warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
2. Operation and Maintenance Data: Submit operation and maintenance data for installed products including but not limited to the following:
   a. Manufacturer’s instructions on maintenance renewal of applied treatments.
   b. Protocols and product specifications for joint filing, crack repair and/or surface repair.

## 1.06 QUALITY ASSURANCE

A. Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

B. Notify the Architect where conflicts apply between referenced standards and materials, and methods of construction.

## 1.07 QUALIFICATIONS

A. Qualifications:

1. Applicator who has demonstrated previous successful work of the type specified herein, with a minimum of 5 years documented experience and certified by product manufacturer.

## 1.08 MOCK-UPS

A. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.

B. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

C. Accepted mock-ups may not remain as part of the work; the number of mock-ups shall not be restricted.

## 1.09 PRE-INSTALLATION CONFERENCE

A. At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 19.23 – CONSTRUCTION MEETINGS. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Architect, Construction Manager, Applicator's Project Superintendent, manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:

   a. Section 03 30 00 – CAST-IN-PLACE CONCRETE.

2. Agenda:

   a. Scheduling of polishing operations.

   b. Review of material storage locations.

   c. Coordination of work by other trades.

   d. Installation procedures for ancillary equipment.

   e. Protection of completed Work.

f. Establish weather and working temperature conditions to which Architect and Contractor must agree.

g. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

1.10 DELIVERY, STORAGE & HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Deliver and store materials in original, sealed, containers showing manufacturer's identification, year of production, new weight, date of packaging, and location of packaging.

C. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

D. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Protect concrete slabs to receive dye and polished finish from the following:

1. Petroleum stains during construction.

a. Diaper hydraulic power equipment.

2. Restrict use of pipe cutting machinery.

3. Restrict placement of reinforcing steel on slab.

4. Restrict use of acids or acidic detergents on slab.

1.12 WARRANTY

A. Submit the following warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT:

1. 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 does not limit, other rights Owner may have under Contract Documents.

1.13 EXTRA MATERIALS

A. Provide maintenance materials in accordance with Section 01 78 00 – PROJECT CLOSEOUT.

## PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on L & M Construction Chemicals, Inc., Omaha, NE Product: "FGS Permashine."

B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. L & M Construction Chemicals, Inc., Omaha, NE.
2. The Bomanite Company, Granite Bay, CA.
3. L.M. Scofield Company, Rutherford, NJ..

2.02 MATERIALS

A. Polished Concrete Finishing Products:

1. Hardener, Sealer, Densifier: Water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
   a. Product: L & M Construction Chemicals, Inc., FGS Hardener Plus.
2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
   a. Product: L & M Construction Chemicals, Inc., Joint Tite 750.
3. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
   a. Product: L & M Construction Chemicals, Inc., Petrotex.
4. Cleaning Solution: Mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
   a. Product: L & M Construction Chemicals, Inc., FGS Concrete Conditioner.
5. Finish: Standard High gloss (HG-1), 1500 grit.
6. Color: As selected by the Architect from the manufacturer's full range of available colors.

2.03 SOURCE QUALITY CONTROL

A. Ensure concrete finishing components and materials are from single manufacturer.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of existing substrate and project conditions.

1. Verify that concrete substrate conditions are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.

3.02 PREPARATION

A. During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

B. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.

C. Examine surface to determine soundness of concrete for polishing.

D. Contractor to remove surface contamination.

3.03 INSTALLATION

A. Floor surface polishing and treatment:

1. Provide polished concrete floor treatment for all areas indicated on the Drawings. Provide consistent finish in all contiguous areas.
2. Apply floor finish prior to installation of fixtures and accessories.
3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit using dry method.
   a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Level of sheen shall match that of approved mock-up.
   b. Expose aggregate in concrete surface only as determined by approved mock-up.
   c. All concrete surfaces shall be as uniform in appearance as possible.
4. Apply hardener/densifier as indicated:
   a. First coat at 250 $ft^2$/gal (6.25 $m^2$/L).

b. Second coat at 350 $ft^2$/gal (8.75 $m^2$/L).

c. Follow manufacturer's recommendations for drying time between successive coats.

5. Remove defects and repolish defective areas.

6. Comply with NFSI Test Method 101-A Phase Two Level High Traction Material.

7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.04 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface.

3.05 CLEANING

A. Comply with requirements for handling and disposition of all construction and demolition waste.

1. Separate waste materials for reuse and recycling.

2. Remove from site and dispose of packaging materials at appropriate recycling facilities.

B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.06 PROTECTION

A. Protect finished work under provisions of Section 01 52 13 - TEMPORARY FACILITIES.

1. Protect with EZ Cover™ by McTech Corp., or approved equal.

END OF SECTION

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**SECTION 03 48 46**

**PRECAST CONCRETE BLOCK**

## PART 1 - GENERAL

**1.01 WORK INCLUDED:**

**A. This section includes design, furnishing and installation of precast concrete block segments for use in construction of a new material storage system as shown on the drawings and as required by the Engineer.**

**B. The Contractor shall furnish all labor, materials, tools and equipment and shall perform all work to satisfactorily install the precast concrete blocks. The work shall include installation and assembly of the precast block segments as shown on the plans.**

**1.02 RELATED WORK:**

**A. Section 31 23 00, EARTHWORK**

**1.03 QUALITY ASSURANCE:**

**A. The block segments shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all design requirements of the precast units.**

**B. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Inspection may be made at the place of manufacture, on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if they fail to meet any of the specification requirements. Any sections which are rejected shall be immediately removed from the job site by the Contractor.**

**1.04 REFERENCES:**

**A. The following standards form a part of this specification, as referenced:**

**American Society for Testing and Materials (ASTM)**

| | | |
|---|---|---|
| **ASTM** | **A615** | **Deformed Billet Steel Bars for Concrete Reinforcement** |

**American Concrete Institute (ACI)**

| | | |
|---|---|---|
| **ACI** | **318** | **Building Code Requirements for Reinforced Concrete** |

**1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS SUBMIT THE FOLLOWING:**

**A. Six (6) sets of manufacturer's literature and shop drawings of the materials of this section shall be submitted to the Engineer for review. The Contractor and his supplier are**

**responsible for the structural integrity of the precast block sections. The design shall be prepared and stamped by a professional structural or civil engineer registered in the state of New York.**

**B. The Contractor shall also submit to the Engineer a detailed written description of the method he proposes to use to accomplish the block wall installation.**

**C. Test reports as required shall be submitted to the Engineer.**

## PART 2 - PRODUCTS

### 2.01 GENERAL REQUIREMENTS:

**A. Each block shall have rough dimensions 2' x 2' x 4' long and be formed with an interlocking key system consisting of a minimum of two (2) tapered knobs with minimum dimensions of 2 5/8" high and 7 5/8" diameter. Blocks shall have beveled edges and shall have openings on the bottom sized to interlock with knobs of other blocks when stacked. Blocks shall contain reinforcement as recommended by the manufacturer.**

**B. Precast sections shall be designed to withstand material loads against each unit and forces associated impacts from front end loaders.**

### 2.02 PRECAST CONCRETE SECTIONS:

**A. Minimum compressive strength of concrete shall be 5,000 psi at 28 days.**

**B. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside face of each block.**

**C. The Engineer reserves the right to reject any precast section and the rejected unit shall be tagged and removed from the job site immediately. The Engineer may also require testing of the concrete, with the Contractor bearing all testing costs.**

## PART 3 - EXECUTION

### 3.01 PRECAST SECTIONS:

**A. All precast sections shall be installed in strict accordance with the shop drawings and the manufacturer's recommendations. The sections shall be carefully placed on the prepared bedding in such manner and by such means as is required to properly control the final positioning.**

**B. The blocks shall be installed to the lines and grades indicated on the drawings.**

**C. The precast reinforced concrete sections shall be set so as to be in true vertical and horizontal alignment.**

**END OF SECTION**

SECTION 04 20 00

UNIT MASONRY

## 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. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Cavity wall insulation.

C. Related Requirements:

1. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

### 1.03 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

## 1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Decorative CMUs.
2. Colored mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep holes and cavity vents.
4. Accessories embedded in masonry.

## 1.06 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, 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 masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. 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 C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. 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 typical exterior wall sizes approximately 60 inches long by 96 inches high by full thickness, including face and backup wythes and accessories.

   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 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
   d. Include cmu back-up, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes 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.

## 1.08 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.

## 1.09 FIELD 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.
    2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover 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 TMS 602/ACI 530.1/ASCE 6.

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 TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

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.

### 2.02 PERFORMANCE REQUIREMENTS

A. Provide structural 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 C1314.

## 2.03 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. 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.

## 2.04 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units:

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

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) Euclid Chemical Company (The); an RPM company.
2) Master Builders Solutions.
3) Moxie International.

C. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi
2. Density Classification: Normal weight
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

D. Decorative CMUs: ASTM C90.

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. Westrbook Block.
b. A. Jandris & Sons.
c. York Building Products.

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi
3. Density Classification: Normal weight.
4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
5. Pattern and Texture:

a. Standard pattern, ground-face finish.

6. Colors: selected by Architect from manufacturer's full range

## 2.05 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

## 2.06 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, 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.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

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. Davis Colors.
    b. Euclid Chemical Company (The); an RPM company.
    c. Solomon Colors Inc.

E. 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) Holcim (US) Inc.
        2) Lafarge North America Inc.
        3) Lehigh Hanson; HeidelbergCement Group.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.

F. Aggregate for Mortar: ASTM C144.

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.

G. Aggregate for Grout: ASTM C404.

H. Refractory Mortar Mix: Ground fireclay or nonwater-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C199 test; or an equivalent product acceptable to authorities having jurisdiction.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition 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. Euclid Chemical Company (The); an RPM company.

b. GCP Applied Technologies Inc.

J. 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Euclid Chemical Company (The); an RPM company.
b. GCP Applied Technologies Inc.
c. Master Builders Solutions.

K. Water: Potable.

2.07 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars 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. Heckmann Building Products, Inc.
b. Hohmann & Barnard, Inc.
c. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch / 3/16” diameter.
4. Wire Size for Cross Rods: 0.187-inch / 3/16” diameter.
5. Wire Size for Veneer Ties: 0.187-inch / 3/16” diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

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. Hohmann & Barnard, Inc.
b. Wire-Bond.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

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. Heckmann Building Products, Inc.
   b. Hohmann & Barnard, Inc.
   c. Wire-Bond.

2. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
3. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
4. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

F. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized carbon steel continuous wire.

## 2.08 TIES AND ANCHORS

A. 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.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A641/A641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
3. Stainless Steel Wire: ASTM A580/A580M, Type 316.
4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.
7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
8. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

C. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch-thick steel sheet, galvanized after fabrication.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.

E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M

G. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.25-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.

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) Hohmann & Barnard, Inc.
2) Wire-Bond.

## 2.09 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.

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) Cheney Flashing Company.
2) Hohmann & Barnard, Inc.
3) Keystone Flashing Company, Inc.

4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

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) Hohmann & Barnard, Inc.
2) Wire-Bond.
3) York Manufacturing, Inc.

C. 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 metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

E. 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.

F. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.010 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, 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 D2000, 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 D226/D226M, 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 less than depth of outer wythe, in color selected from manufacturer's standard.

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) Heckmann Building Products, Inc.
2) Hohmann & Barnard, Inc.
3) Wire-Bond.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

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. Hohmann & Barnard, Inc.
b. Keene Building Products.
c. York Manufacturing, Inc.

2. Configuration: Provide one of the following:

a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.011 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

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. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2. The following methods are *not acceptable* for cleaning the masonry:
    a. Hydrochloric Acid
    b. Muratic Acid
    c. Pressurized Water Blasting
    d. Abrasive Blasting

2.012 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.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Application: Use pigmented mortar for exposed mortar joints with the following units:

    a. Decorative CMU

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

## PART 3 - EXECUTION

### 3.01 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.

### 3.02 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.

### 3.03 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 inch.
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. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 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.

## 3.04 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 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 4-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 cmu 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 07 84 43 "Joint Firestopping."

## 3.05 MORTAR BEDDING AND JOINTING

A. Lay CMUs 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive air barriers unless otherwise indicated.

## 3.06 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

2. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.
3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.

E. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

## 3.07 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

## 3.08 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 control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

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 07 92 00 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

## 3.09 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.010 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. 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. Retain any of nine subparagraphs below and revise to suit wall configurations used. Arrangement of flashing can be communicated better by detailing on Drawings rather than by relying on any of the nine subparagraphs.
   3. 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 air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
   4. 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.
   5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
   6. 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.

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. Space weep holes 24 inches o.c. unless otherwise indicated.
   3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products or open-head joints to form cavity vents.

   1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

## 3.011 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

## 3.012 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 DIVISION 01 SPECIFICATIONS.

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. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

J. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

## 3.013 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."

## 3.014 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.
2. Do not dispose of masonry waste as fill within 18 inches of finished grade.

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 04 20 00

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

## 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. Exterior non-load-bearing wall framing.
2. Ceiling joist framing.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

### 1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

### 1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Exterior non-load-bearing wall framing.
2. Vertical deflection clips.
3. Single deflection track.
4. Drift clips.
5. Ceiling joist framing.
6. Post-installed anchors.
7. Power-actuated anchors.
8. Sill sealer gasket.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

## 1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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. AllSteel & Gypsum Products, Inc.
2. CEMCO; California Expanded Metal Products Co.
3. ClarkDietrich.
4. Consolidated Fabricators Corp.; Building Products Division.
5. MarinoWARE.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
   b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 1/2 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

## 2.03 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance
2. Coating: G90 or equivalent

B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance
2. Coating: G90

## 2.04 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 2 inches

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 1-1/4 inches

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

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. ClarkDietrich.
b. Steel Construction Systems.
c. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with

flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.05 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 20 MILS, minimum thickness.
2. Flange Width: 2 inches
3. Section Properties: Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs
2. Flange Width: 1-1/4 inches

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

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. ClarkDietrich.
b. Steeler, Inc.
c. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 20 MILS, minimum thickness.
2. Flange Width: 1 inch plus the design gap for one-story structures

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.06 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 2 inches minimum.

## 2.07 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 2 inches minimum.

## 2.08 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

## 2.09 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 55, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on

ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.010 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

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. Polyguard Products, Inc.

2. Physical Properties:

a. Peel Adhesion: 17.0 lb/in of width when tested in accordance with ASTM D412.
b. Low-Temperature Flexibility: Pass at minus 25 deg FASTM D146/D146M.
c. Water Vapor Permeance: 0.05 perm maximum when tested in accordance with ASTM E96/E96M, Method B.
d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.011 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing 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.

## 3.02 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

## 3.03 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

## 3.04 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at 96-inch centers

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

## 3.05 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

## 3.06 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

## 3.07 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.08 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 50 00

METAL FABRICATIONS

## 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. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Slotted channel framing.
4. Shelf angles.
5. Structural-steel door frames.
6. Miscellaneous steel trim including loading-dock edge angles.
7. Metal bollards.
8. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

### 1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

## 1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Slotted channel framing.
6. Metal bollards.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Structural-steel door frames.
5. Miscellaneous steel trim including loading-dock edge angles.
6. Loose steel lintels.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research Reports: For post-installed anchors.

## 1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled-Stainless Steel Floor Plate: ASTM A793.

G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

I. Zinc-Coated Steel Wire Rope: ASTM A741.

1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

J. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.

1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Steel Prestressing Strand: ASTM A416/A416M, Grade 270, low-relaxation, seven-wire, with 0.9-lb/sq. ft.zinc coating.

1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.

L. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated
2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33]; 0.0677-inch minimum thickness; hot-dip galvanized after fabrication.

M. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

N. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

O. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

P. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

Q. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

R. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).

S. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semired brass).

T. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.

U. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

## 2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening stainless steel.
2. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.04 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 90 00 “Painting”.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

## 2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill or punch girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

F. Galvanize miscellaneous framing and supports where indicated.

G. Prime miscellaneous framing and supports with zinc-rich primer indicated.

## 2.07 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.08 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

C. Galvanize and prime steel frames.

D. Prime exterior steel frames with zinc-rich primer.

## 2.09 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.010 METAL BOLLARDS

A. Fabricate metal bollards from steel shapes, as indicated.

1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Prime steel bollards with zinc-rich primer.

C. accessories for securing to structural columns and walls and for tightening barrier cable.

2.011 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.012 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.013 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.014 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09 90 00 “Painting” unless zinc-rich primers are indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.015 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

# PART 3 - EXECUTION

## 3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

## 3.02 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for coiling doors securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

## 3.03 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.

B. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

## 3.04 INSTALLATION OF BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3.05 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 – “Painting”

B. welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 05 51 13

METAL PAN STAIRS

## 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. Preassembled steel stairs with concrete-filled treads.
2. Railings and guards attached to metal stairs.
3. Handrails attached to walls adjacent to metal stairs.

### 1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

### 1.04 ACTION SUBMITTALSp

A. Product Data: For metal pan stairs and the following:
1. Prefilled metal-pan-stair treads.

2. Abrasive nosings.
3. Shop primer products.
4. Nonslip-aggregate concrete finish.
5. Handrail wall brackets.
6. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

a. Repair or replace damaged materials or structures as directed.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs, railings and guards including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
   b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

   a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

### 2.02 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40 for handrails, Schedule 80 for guardrails, vertical posts & horizontal members), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

2.03 ABRASIVE NOSINGS

A. Cast-Metal Units: Cast aluminum with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

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. American Safety Tread Co., Inc.
b. Balco; a CSW Industrials Company.
c. Wooster Products Inc.

2. Configuration: Cross-hatched units, 3 inches wide without lip.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

D. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.04 FASTENERS

A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs and/or stairs indicated to be galvanized.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.05 MISCELLANEOUS MATERIALS

A. Handrail Wall Brackets: Cast aluminum, center of rail 1-1/2 inches clear from face of wall to face of railing.

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. Blum, Julius & Co., Inc.
b. The Wagner Companies.

B. Welding Electrodes: Comply with AWS requirements.

C. Shop Primers: Provide primers that comply with Section 09 90 00, “PAINTING”.

D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

E. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I-A, Level 1, and compatible with topcoat.

F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

J. Prefilled Concrete Treads:

1. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum

28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.

2. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
3. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, galvanized steel, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated on Drawings.

4. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.

    a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

K. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.06 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.

5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

## 2.07 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Service Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers steel channels as indicated on Drawings.

   a. Stringer Size: As required to comply with "Performance Requirements" Article
   b. Provide closures for exposed ends of channel and rectangular tube stringers.
   c. Finish: Shop primed unless exterior or noted as galvanized.

2. Construct platforms of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

   a. Provide closures for exposed ends of channel and rectangular tube framing.
   b. Finish: Shop primed unless exterior or noted as galvanized.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.

   a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.

2. Steel Sheet: Galvanized-steel sheet.
3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. Attach abrasive nosings to risers.
7. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
8. Provide epoxy-resin-filled treads, reinforced with glass fibers, with non-slip-concrete aggregate finish to tread surface.
9. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.097 inch.

1. Steel Sheet: Uncoated, hot-rolled steel sheet unless otherwise indicated.
2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

## 2.08 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

## 2.09 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise

indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.

a. Clean bottom surface of plates.
b. Set plates for structural members on wedges, shims, or setting nuts.
c. Tighten anchor bolts after supported members have been positioned and plumbed.
d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.

G. Install precast concrete treads with adhesive supplied by manufacturer.

H. Install precast terrazzo treads according to manufacturer's written instructions.

## 3.03 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts, rail ends, and guard ends to building construction as follows:

a. Anchor posts to steel by welding to steel supporting members.
b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Install railing gates level, plumb, and secure for full opening without interference.

1. Attach hardware using tamper-resistant or concealed means.
2. Adjust hardware for smooth operation.

C. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as follows:

a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
b. For hollow masonry anchorage, use toggle bolts.
c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
d. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

e. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

f. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

## 3.04 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00, “PAINTING”.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 05 51 19

METAL GRATING STAIRS

## 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. Industrial Class stairs with steel-grating treads.
2. Steel railings and guards attached to metal stairs.
3. Steel handrails attached to walls adjacent to metal stairs.

### 1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

### 1.04 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Shop primer products.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs, railings, and guards, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.50.

2.02 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

D. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

E. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.

F. Aluminum Bars for Grating Treads: ASTM B221 extruded aluminum, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

G. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.
1. Provide galvanized finish for exterior installations and where indicated.

H. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
1. Provide galvanized finish for exterior installations and where indicated.

## 2.03 FASTENERS

A. General: Provide [zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs stairs indicated to be galvanized stairs indicated to be shop primed with zinc-rich primer.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1] [Group 2] stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.04 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting"

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I-B, Level 1, and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with ASTM A780/A780M and compatible with paints specified to be used over it.

G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

## 2.05 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

## 2.06 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel channels.

a. Stringer Size: As indicated on the Drawings.
b. Provide closures for exposed ends of channel stringers.
c. Finish: Shop primed

2. Construct platforms and tread supports of steel plate or channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel framing.
b. Finish: Shop Primed.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.

4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from galvanized steel grating with 1-by-1-1/4-inch bearing bars at 1-3/16 inch o.c and crossbars at 4 inches o.c.

a. Surface: Plain.
b. Finish: Galvanized.

2. Fabricate grating treads with checkered plate 90 degree nosing and with steel angle or steel plate carrier at each end for stringer connections.

    a. Secure treads to stringers with bolts.

3. Fabricate grating platforms with nosing matching that on grating treads.

    a. Secure grating to platform framing with bolts.

D. Risers: Open

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.

1. Material and Finish: Steel plate to match finish of other steel items.
2. Fabricate to dimensions and details indicated.

## 2.07 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

## 2.08 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.

a. Clean bottom surface of baseplates.
b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
c. After stairs have been positioned and aligned, tighten anchor bolts.
d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

## 3.03 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts, rail ends, and guard ends to building construction as follows:

a. Anchor posts to steel by welding or bolting to steel supporting members.
b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements.

## 3.04 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting”.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 05 52 13

PIPE AND TUBE RAILINGS

## 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. Steel railings.

B. Related Requirements:

1. Section 05 51 19 "Metal Grating Stairs" for steel tube railings associated with metal pan stairs.

### 1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. 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.

### 1.04 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Intermediate coats and topcoats.
7. Bituminous paint.
8. Nonshrink, nonmetallic grout.
9. Anchoring cement.

10. Metal finishes.
11. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of connecting and finishing members at intersections.

E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

## 1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.08 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

## 2.03 STEEL RAILINGS

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. Kee Safety, Inc.
2. R & B Wagner, Inc.
3. VIVA Railings, LLC.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

C. Tubing: ASTM A500/A500M (cold formed)

D. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

E. Plates, Shapes, and Bars: ASTM A36/A36M.

F. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

## 2.04 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.05 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Handrails from edge of handrail 1-1/2 inches from face of wall that railing attaches to.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Section 099000 “Painting”

F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

I. Intermediate Coats and Topcoats: Provide products that comply with Section 09 90 00 “Painting”.

J. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

K. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

L. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

M. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

N. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.06 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.

K. Form changes in direction as follows:

1. By bending to smallest radius that will not result in distortion of railing member.

L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

## 2.07 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner, and as follows.

1. Comply with SSPC-SP 16.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3:

1. Exterior Railings: SSPC-SP 6/NACE No. 3.
2. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
3. Other Railings: SSPC-SP 3.

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with primers specified in Section 09 90 00 "Painting" unless zinc-rich primer is indicated.
2. Do not apply primer to galvanized surfaces.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

### 3.02 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

## 3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

## 3.04 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

E. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
2. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
3. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.

## 3.05 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with flanges connected to brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads.

## 3.06 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 “Painting”.

## 3.07 CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

## 3.08 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

## 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. Framing with dimension lumber.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Utility shelving.
6. Plywood backing panels.

### 1.03 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include

physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

## 1.05 INFORMATIONAL SUBMITTALS

A. 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 ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

## 1.06 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.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

# PART 2 - PRODUCTS

## 2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall 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.

## 2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

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.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.[For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
2. Framing for non-load-bearing partitions.
3. Roof construction.
4. Plywood backing panels.

## 2.04 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. Cants.
4. Furring.
5. Grounds.
6. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 in any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Utility Shelving: Lumber with 15 percent maximum moisture content of any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine or southern pine; No. 2 grade; SPIB.
3. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
4. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.
6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

E. 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.

F. 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.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.05 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## 2.06 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

## 2.07 METAL FRAMING ANCHORS

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. Cleveland Steel Specialty Co.
2. Simpson Strong-Tie Co., Inc.
3. USP Structural Connectors.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated products. 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.

1. Use for exterior locations and where indicated.

## 2.08 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

# PART 3 - EXECUTION

## 3.01 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

G. Do not splice structural members between supports unless otherwise indicated.

H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

K. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

L. Securely attach rough 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 (IBC).
2. ICC-ES evaluation report for fastener.

M. 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.

N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

## 3.02 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for screeding or 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.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

## 3.03 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

## 3.04 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.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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SECTION 06 16 00

SHEATHING

## 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. Wall sheathing.
2. Roof sheathing.
3. Composite nail base insulated roof sheathing.
4. Underlayment.
5. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry"
2. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

### 1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.

3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

E. Field quality-control reports.

## 1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

# PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing Performance: Air-barrier and water-resistant glass-mat gypsum sheathing assembly, and seals with adjacent construction, shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations tie-ins to other installed air barriers, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

## 2.02 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet 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.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

## 2.03 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing

## 2.04 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified.[ For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.]

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof sheathing.
2. Elec Panel Backer Panels

## 2.05 WALL SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

## 2.06 ROOF SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16
2. Nominal Thickness: Not less than 1/2 inch.

## 2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

## 2.08 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

# PART 3 - EXECUTION

## 3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Use common wire 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. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION 06 16 00

SECTION 06 20 00

FINISH CARPENTRY

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install:

1. Interior finish wood trim.
   a. Window sills.
2. Adjustable wall mounted shelving with standards and brackets.
3. Storage and closet shelving, coat rods and related hardware.

B. Install the following furnished under the designated Sections:

1. Handrail brackets furnished by Section 05 50 00 – METAL FABRICATIONS.
2. Steel and Stainless doors furnished by Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.
3. Wood doors furnished by Section 08 14 16 - FLUSH WOOD DOORS.
4. Door hardware, thresholds, weather stripping, seals and gaskets furnished by Section 08 71 00 - DOOR HARDWARE.

C. Backprime all interior window stools, and all wood which comes in contact with cementitious and masonry materials

D. No attempt is made in this Section to list all elements of finish carpentry required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, framing, curbs, nailers, and backer boards.

B. Section 07 92 00 - JOINT SEALANTS: Sealant and backing materials, for joints between casework, countertops and abutting surfaces.

C. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal doors.

D. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors.

E. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, weatherstripping, thresholds, seals and gaskets for installation under this Section 06 20 00.

F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work, and attachment.

G. Section 09 29 00 - GYPSUM BOARD: Drywall construction work having taped and compounded finish.

H. Section 09 91 00 - PAINTING: Field applied primer (excluding backpriming) and finish coatings.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
2. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.
3. APA - applicable grades and specifications.
4. FS MM-L-736 - Lumber; Hardwood
5. PS-1 - Construction and Industrial Plywood.
6. PS-20 - American Softwood Lumber Standard.
7. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
8. SPIB Grading Rules, current edition.
9. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
10. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.
11. AWPA C-20 - Structural Lumber Fire Retardant Treatment by Pressure Processes.

12. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
13. MIL L1914OE - Lumber and Plywood, Fire Retardant Treated.
14. UL Building Materials Directory.

## 1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for hardware, adhesives and accessories furnished hereunder.
2. Certification:
   a. Fire Treatment: Written certification from the respective treatment plants indicating types of fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
      1) Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
      2) Provide report from National Evaluation Service Committee on fire retardant treated wood flame spreading, strength, corrosion and hygroscopic properties.
3. Shop drawings:
   a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing profiles, jointing and fastening methods; and complete installation details.
   b. Provide full scale drawings of wood trim elements showing all profiles and dimensions.
   c. Provide shop drawings bearing dimensions of actual measurements taken at the project.
4. Samples: Provide samples as requested by Engineer for selection of colors and finishes.

## 1.05 QUALITY ASSURANCE

A. Quality Standards: All materials and workmanship scheduled to receive transparent finishes shall meet AWI Premium grade quality standards. All other materials and workmanship shall meet AWI Custom grade quality standards.

B. Install work in accordance with the latest specified AWI quality standards, except that standing and running trim joints shall be field mitered and fitted.

C. Discard lengths of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver interior finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.

B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location maintaining 60 degrees Fahrenheit and a maximum relative humidity of 55 percent.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

## PART 2 – PRODUCTS

2.01 WOOD MATERIALS – GENERAL REQUIREMENTS

*A.* General: Materials, as fabricated and installed, shall comply with specified quality grades of AWI/AWMAC/WI *Architectural Woodwork Standards.*

1. All board products shall be S4S, except as otherwise specified.

B. Panel Products: Composite panel products and plywood shall be "no added urea-formaldehyde", including all concealed components.

1. Composite panel products include but are not limited to particleboard (PB), Medium Density Fiberboard (MDF), wheatboard and strawboard and similar manufactured products.

C. Moisture content:

1. Wood for interior use shall have a moisture content between 5 and 10 percent, when delivered to the project.

2.02 BOARD AND PANEL MATERIALS

A. Interior trim to receive paint (opaque finish): Wood shall be clear without knots or surface defects. and conform to AWI/AWMAC/WI "Architectural Woodwork Standards," latest edition for specified quality grades, (as installed). Acceptable wood species are limited to the following:

1. Yellow Poplar (Lirodendron tulipfera), Plain Sawn, clear straight-grained, C-Select or better.
2. Natural Birch" Yellow Birch (Betula alleghaniensis), Plain Sawn.
3. Natural Maple (Acer saccharum), Plain Sawn.

B. Interior trim and wood handrails furnished under this Section, scheduled to receive transparent finish: White Maple (Acer saccharum), Plain Sawn, AWI Premium Grade (as installed).

C. Plywood and panel products:

1. Shelving to receive paint: 3/4 inch thick Birch veneer plywood (AA) with 3/8 inch hardwood edge banding at all edges.
2. Engineered panels scheduled for opaque finish: Medium Density Fiberboard (MDF) of thickness indicated on the Drawings, conforming to ANSI A208.2 product class MD, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m$^3$). Acceptable products include the following or approved equal.
   a. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MDF".
   b. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor MDF Plus"
   c. SierrePine Inc., Martel, CA., product "Medite II"
   d. Temple Inland, Austin TX., product "UltraStock – Free."
3. Particle board: Mattformed three layer medium density wood particle panel, general use grade per ANSI A 208.1 with an minimum density of 48 pounds per cubic foot, fabricated using formaldehyde free synthetic resin. Acceptable products include the following or approved equal.
   a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor Particleboard Plus"
   b. Plummer Forest Products, Post Falls ID., product "PFP particleboard".
   c. Rodman Industries, Oconomowoc, WI., product: "Rodman Resincore I".
   d. SierrePine Inc., Martel, CA., product "Encore SDP"
4. Engineered panels scheduled for veneer finish: Medium Density Fiberboard (MDF) of thickness indicated and as detailed on the Drawings, conforming to ANSI A208.2 product class MD, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m$^3$).
   a. Flakeboard, Toronto, Ontario, Canada, product: "Superior MDF".
   b. SierrePine Inc., Moncure, NC, product "Medite II".
   c. Plum Creek Timber Company Inc., Seattle, WA, product "Standard MDF".
5. Veneer: Select White Maple (Acer saccharum) {sapwood}, Plain Sliced, AWI Premium Grade

D. Provide other finish carpentry products, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

## 2.03 CLOSET AND SHELVING HARDWARE

A. Metal closet rods and brackets:

1. Closet pole: 0.109 inch (92.77 mm) wall thickness steel tubing, 1-5/16 inch diameter, of custom cut lengths required for full width of closet, chrome finish.
   a. Provide intermediate supports for span lengths greater than 48 inches.

B. Adjustable shelving, wall mounted standards and brackets:

1. Acceptable manufacturers, include the following, or approved equal:
   a. Knape & Vogt, Grand Rapids MI.
   b. Spur Systems International Limited.
   c. Reeve Store Equipment Company (ReeveCo), Pico Rivera CA.
2. Standards (uprights): 14 gage double tracked uprights, in epoxy powder-coat finish, color as selected by Engineer from manufacturer's full range of colors.
   a. Locate uprights no greater than 24 inches on center.
3. Brackets: 14 gage formed brackets, color and finish matching standards,
   a. Depth (typical): 270mm (10-1/2 inch depth), or as otherwise indicated on Drawings.

## 2.04 ACCESSORIES AND HARDWARE

A. Glue for lamination and fabrication of wood, plywood and particleboard items: Exterior Grade, phenolic resin glue.

B. Nails:

1. otherwise specified herein.

C. Screws: Flat-head wood screws of the appropriate sizes, galvanized finish for interior use.

D. Bolts, nuts, washers, blind fasteners, lags: Galvanized, of size and type to suite application as indicated in the drawings.

E. Paint for back-priming:

1. Products which may be considered as equal include the following, or approved equal:
   a. California: "Wipe-Out 100% Acrylic Latex Stain Block", Nº 52500.
   b. Glidden: Wall and Woodwork Primer Sealer, Nº 1020.
   c. Moore: "Alkyd Enamel Underbody", Nº. 217.
   d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
   e. Sherwin-Williams: "Wall and Wood VOC Primer", B49 WZ2 Series.

2.05 WOOD TREATMENTS

A. Comply with requirements specified under Section 06 10 00 - Rough Carpentry.

**PART 3 – EXECUTION**

3.01 EXAMINATION

A. Verify adequacy of blocking, backing and support framing for all finish carpentry work.

B. Beginning of installation means acceptance of site conditions.

3.02 PREPARATION

A. Prime all wood surfaces of items or assemblies to be in contact with cementitious and masonry materials, prior to installation.

3.03 INSTALLATION – GENERAL CARPENTRY

A. Comply with installation requirements of AWI (Architectural Woodwork Institute) Architectural Woodwork Standards (1st Edition, 2009) for Premium Grade quality work.

B. Dress and sand woodwork until free from machine and tool marks, abrasions, raised grain, or other defects that will show through the finish on surfaces exposed to view. Wherever possible, carry out sanding on a shop belt sander, not in the field. Sandpaper field joints and leave in perfect condition for finishing.

C. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point. Joints shall be glued tight and so formed as to conceal shrinkage. Cope trim at returns and miter at corners to produce tight-fitting joints with full surface contact throughout length of joint.

D. Make a minimum of splices and joints in running trim, and where such splices and joints occur, fasten securely, with all exposed surfaces having smooth, continuous planes. Stagger joints in adjacent or relate members. Use scarf joints for end-to-end joints.

E. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces in prefinished items.

F. All nails in interior finished work shall be blind nailed wherever possible. Nail trim with finish nails only, set using appropriate nail punch and fill with matching wood filler. Sand smooth wood filler. Do not fasten trim with screws or bolts unless otherwise directed, or is to be subsequently covered with smaller trim.

G. Woodwork shall be properly framed, closely fitted and accurately set to the required lines and levels and shall be rigidly secured in place. Shim as

required using concealed shims to achieve specified tolerances.

H. Cover exposed edges of plywood shelving with 3/8 inch hardwood edging. Width of edging to match thickness of shelving.

3.04 INSTALLATION – PREFABRICATED PRODUCTS INSTALLED UNDER THIS SECTION

A. Do not commence installation of products until immediately adjacent surfaces have been completely installed and finished.

B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.

C. Install products absolutely level and in true line, with units securely anchored to the surrounding construction.

D. Remove all tape and other packing materials; thoroughly clean and polish all exterior and interior surfaces.

E. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.05 INSTALLATION – DOORS AND HARDWARE

A. Install doors in accordance with the manufacturer's recommendations, ANSI/SDI-100, ANSI A250.11, and the Door Hardware Institute recommendations.

B. Install hardware in accordance with manufacturer's instructions and requirements of referenced organizations, and the requirements of Section 08 71 00 - Door Hardware.

1. Use the templates provided by hardware item manufacturer.
2. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
   a. Conform to ANSI 117.1 for positioning requirements for the handicapped.
   b. “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute (DHI.)
   c. WDMA Industry Standard I.S.1.7, “Hardware Locations for Wood Flush Doors”.
3. Installation of hardware shall comply with NFPA 80 and NFPA 101 requirements
4. Prefit hardware before finish is applied, remove and reinstall after finish is completed. Install hardware so that parts operate smoothly, close tightly and do not rattle.
5. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

C. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Securely and

permanently anchor thresholds, using countersunk non-ferrous screws to match color of thresholds (stainless steel screws at aluminum thresholds).

D. Tools for maintenance: All special tools packaged with hardware items shall be saved, tagged/identified as to product use, and turned over to the Owner upon completion of the Work.

E. Clean adjacent surfaces soiled by hardware installation.

F. Prior to Final Inspection make final check and adjustment of all hardware, clean operating items as necessary to restore proper function and finish of hardware.

3.06 TOLERANCES

A. Maximum variation for wood work from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.

B. Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

3.07 ADJUSTING

A. Adjust doors for smooth and balanced movement.

3.08 CLEANING

A. Daily clean work areas by sweeping and disposing of scraps and sawdust.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

C. Remove protective material from pre-finished surfaces.

3.10 PROTECTION

A. During the operation of finish carpentry, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

END OF SECTION

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SECTION 06 40 00

ARCHITECTURAL WOODWORK

## PART 1 - GENERAL

### 1.01 SUMMARY

A. The work of this Section consists of shop fabricated millwork and architectural woodwork where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.

B. Furnish and install the following:

1. Wood veneer casework.
2. Plastic laminate casework
3. Exposed blocking and blocking concealed by the work of this Section required for the installation of architectural woodwork.
4. Hardware for work of this Section.
5. Sealant, for joints between countertops, cabinets and abutting wall and partition surfaces.

C. Make all cutouts within casework items as required to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.

D. No attempt is made in this Section to list all elements of architectural woodwork required on this project or to describe how each element will be installed. It is the responsibility of the Construction Manager to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

### 1.02 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

B. Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED V4 BD+C) certification. Certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.

C. Section 05 50 00 - METAL FABRICATIONS: Supports for countertops.

D. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.

E. Section 06 20 00 - FINISH CARPENTRY:

1. Fixed wood shelving and trim.

2. Installation of wood interior and exterior trim furnished under this Section 06 40 00.
3. Wood trim.

F. Section 06 61 16 – SOLID SURFACING FABRICATIONS.

G. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.

H. Section 09 29 00 - GYPSUM BOARD: Wallboard construction work, having taped and compounded joint finish.

I. Division 22 - PLUMBING: Plumbing fixtures and piping.

J. Division 26 - ELECTRICAL: Electrical connections for lighting.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
1. ASTM D 523 - Standard Specification for Specular Gloss.
2. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.
3. AWI Quality Certification Program.
4. APA Grades and Specifications.
5. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
6. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
   a. PS-1 - Construction and Industrial Plywood Standard.
   b. PS-20 - American Softwood Lumber Standard.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
1. Field Measurements: Where possible the woodwork manufacturer shall take field measurements before preparation of shop drawings and fabrication to ensure proper fitting of Work.

a. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

2. Field dimensions which are not controlled by Project conditions: The woodwork manufacturer is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.

   a. The Construction Manager shall acknowledge the woodwork fabricator's need for accurate field dimensions prior to custom fabrication.

   b. The Construction Manager and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

B. Scheduling:

1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, for each item furnished hereunder, including, but not limited to: Fastenings, adhesives, hardware, and accessories.

   a. Provide additional information required for fillers and finish products: Include, chemical, functional, and environmental characteristics, limitations and special application requirements. Identify available colors, shades, and gloss.

2. Shop drawings bearing dimensions of actual measurements taken at the project, include at least the following, which are in addition to shop drawing requirements described in AWI Quality Standards:

   a. 1/4 inch scale elevations and plans of each casework item.

   b. Large scale design details of minimum 1-1/2 inch to 1-foot scale, showing abutting materials, installation conditions, clearances. Show woodwork profiles, jointing and fastening methods; details of drawers and doors.

   c. Full size or half-full size sections, showing individual components, profiles and jointing.

3. Selection Samples:

   a. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Engineer.

   b. Provide additional samples as requested by Engineer for initial selection of material colors and finishes.

4. Verification Samples:

a. 12 by 12 inch samples of wood veneer illustrating maximum range of color variations and applied transparent shop finish.

b. 12 inch long samples of solid hardwoods illustrating maximum range of color variations and applied transparent shop finish.

c. One each of all cabinet hardware. (approved cabinet hardware samples will be returned to Construction Manager and may become part of the Work).

5. Certificates:

6. Manufacturer's Instructions: Provide installation instructions and templates for hardware and field applied items.

B. Sustainable Design Requirements:

1. For Building E, submit completed LEEDv4 Materials Reporting for applicable material requirements as required in Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS. Submit all required backup documentation.

2. Include submittal documentation requirements for IEQ Credit 2 Low Emitting Materials, On-Site Wet-Applied Products (paints, coatings, sealants and adhesives) to provide both CDPH Standard Method v1.1-2010 emissions compliance and VOC compliance in accordance with SCAQMD Rule 1113 - June 3, 2011 or CARB 2007 SCM (paints and coatings) AND/OR SCAQMD Rule 1168 - July 1, 2005 (adhesives and sealants). Products Tested/Certified under the following programs will meet the emissions requirement: FloorScore; SCS Indoor Advantage Gold; UL Greenguard Gold; CRI Green Label Plus, MAS Certified Green.

3. Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization - Environmental Product Declarations for EPDs.

4. Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization - Sourcing of Raw Materials for certified wood including FSC Chain of Custody (COC) certificate and invoice indicating material cost and COC number.

5. Include submittal documentation requirements for IEQ Credit 2 Low Emitting Materials, Composite Wood Products to demonstrate compliance with California Air Resources Board (CARB) ATCM for ultra-low emitting formaldehyde (ULEF) resins or no-added formaldehyde (NAF) resins.

6. Emitting Materials, Ceilings and Walls to provide CDPH Standard Method v1.1-2010 emissions compliance. Products Tested/Certified under the following programs will meet the emissions requirement: SCS Indoor Advantage Gold; UL Greenguard Gold; MAS Certified Green.

## 1.06 QUALITY ASSURANCE

A. Quality Standards: All work performed under this Section shall be of quality grades, indicated below, as defined in the referenced AWI "Quality Standards, as modified herein by this Specification Section.

1. All work having a transparent wood finish: Premium grade.

B. Qualifications:

1. Fabricator/Installer: AWI member specializing in architectural woodwork of type specified herein having a minimum of 5 years documented experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. General: The woodwork manufacturer, woodwork installer and the Construction Manager are jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in ambient humidity and relative moisture content.
2. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of woodwork items.
3. Sequence deliveries to avoid delays and to minimize on-site storage.

B. Storage and Handling Requirements:

1. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

1.08 SITE CONDITIONS

A. Temperature: Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of architectural woodwork; maintain temperature after installation until Owner's Final Acceptance.

B. Relative Humidity: Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of architectural woodwork: maintain relative humidity after installation until Owner's Final Acceptance.

## PART 2 - PRODUCTS

2.01 WOOD MATERIALS – GENERAL REQUIREMENTS

A. General requirements: New, dressed four sides (S4S), and free from warping and other defects.

B. Panel Products: Composite panel products and plywood shall be "no added urea-formaldehyde", including all concealed components.

1. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheat board and strawboard and similar manufactured products.
2. Moisture Content:
    a. Solid hardwood(s) scheduled for transparent finish: Moisture content shall not exceed 8 percent when delivered to Project.
    b. Typical (hardwood and softwoods): Moisture content of wood shall be between 5 and 10 percent when delivered to the project.

C. Wood Species:
1. Exposed wood scheduled for transparent finish (including but not limited to wood window stools, wood trim, tack board frames and edge trim), meeting AWI Premium Grade Standards (as installed).
    a. Wood species: Select White Maple (Acer saccharum), Plain Sliced, AWI Grade I.
    b. Wood shall color match specified veneer, and be clear without knots, and other natural defects.
2. Exposed wood scheduled for opaque finish (for frames, shelves, fillers, edge trim and drawer construction): White Birch, plain sliced, meeting AWI Premium Grade Standards. Additionally, wood shall be clear without knots, and other natural defects.

D. Panel Products:
1. Engineered panels scheduled for opaque finish: Medium Density Fiberboard (MDF) of thickness indicated on the Drawings, conforming to ANSI A208.2, product class MD-EXT having a minimum density of 45 pounds per cubic foot (769 kg/m$^3$).
    a. Georgia Pacific product "Synergite".
    b. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MR MDF".
    c. Norbord Industries Inc., Deposit, NY, Product: "Norbord MR"
    d. SierrePine, product "Medex NC"

E. Concealed supports for edge and corner backing shall be kiln dried birch or poplar, meeting AWI Premium Grade Standards.

F. Blocking and furring at base and walls shall comply with American Softwood Lumber Standard PS 20-70 and with specific grading requirements of SPIB: Kiln dried (KD15), Structural Light Framing, Nº. 2 grade, free of warping and large knots.

G. Internal concealed framing for casework: Kiln-dried, (KD15), eastern pine, poplar, eastern spruce, or southern pine, conforming to AWI Premium grade.

H. Fir plywood for concealed from view applications in conjunction with the various casework items: APA C-C PLUGGED EXT.

2.02 WOOD VENEERS

A. Veneered panels for transparent finish: The face veneer for transparent finishes shall be minimum 1/28 inch thick on doors, shelves, panels and other exposed surfaces meeting AWI Premium Grade Standards (installed). Each exposed face shall be of tight smooth veneer with joints parallel to vertical edges with no sharp contrasts.

1. Wood Species: Select White Maple (Acer saccharum), Plain Sliced, Grade A.
2. Matching of adjacent pieces of veneer: book matched.
3. Panel face assembly: Balanced Running.
4. Direction of Grain: Vertical
5. Matching of Adjacent Panels: Sequence matched uniform size sets.

2.03 PLASTIC LAMINATE FACING

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated into the work include the following, or approved equal:

1. Formica Corp., Cincinnati, OH.
2. Laminart, Elk Grove Village, IL.
3. Pioneer Plastics Corp. (Pionite), Auburn, ME.
4. Nevamar Corp., Odenton, MD.
5. Ralph Wilson Plastics Co., (Wilsonart), Temple, TX.

B. Plastic laminate, general purpose, conforming to NEMA LD3.1 – 1991 Grade GP50, nominal 0.050 inch thickness, in a low non-directional texture in color price group selected by the Engineer.

C. Plastic laminate, unfinished balancing (backer) sheet, conforming to NEMA LD3 – 1985, undecorated laminate, Grade BK20, 0.020 inch nominal thickness.

2.04 BACKING FOR LAMINATES AND VENEERS

A. Cabinetry case body, and countertops without sinks: Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot or equivalent hardwood plugged plywood complying with PS 51-71.

1. “No Formaldehyde Added”: Provide board which is fabricated using pre-consumer recycled wood fibers and an exterior-grade urea-formaldehyde free resin binder. Product shall contain no formaldehyde additives. Acceptable products include the following or approved equal.

a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: “PureKor Particleboard Plus”
b. Plummer Forest Products, Post Falls ID., product “PFP particleboard”.
c. Rodman Industries, Oconomowoc, WI., product: “Rodman Resincore I”.
d. SierrePine Inc., Martel, CA., product “Encore SDP”

2. Thicknesses:
a. 3/4 inch thick at cases.
b. 1 inch thick at shelves under 30 inches wide.
c. 1 1/8 inch thick at shelves 30 inches or more wide.
d. 1 1/8 inch thick at counters without sinks.

B. Countertops with sinks and similar wet conditions: APA C-C PLUGGED EXT, fir plywood, sanded.

C. Drawers and doors: Medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 45 pounds per cubic foot.
1. Acceptable products include the following or approved equal:
a. Canfibre Group Ltd., Toronto, Ontario Canada, product: “AllGreen MDF”.
b. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: “PureKor MDF Plus”
c. SierrePine Inc., Martel, CA, product “Medite II”
d. Temple Inland, Austin TX, product “UltraStock – Free.”

2. Thicknesses:
a. Typical: 3/4 inch thick panels, except as otherwise indicated or specified.
b. Doors over 36 inches tall: provide 1-1/4 inch thick panels.

## 2.05 CABINET HARDWARE

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Accuride Corp., Santa Fe Springs, CA.
2. CompX International, Inc., Dallas TX.
3. Doug Mockett & Company, Inc., Manhattan Beach, CA.
4. Engineered Products Company, Flint MI.
5. Glynn-Johnson, Indianapolis IN.
6. Grass America Inc., Kernersville NC.
7. H.B. Ives Company, Wallingford CT.

8. Häfele America Company, Archdale NC.
9. Julius Blum, Inc. , Stanley NC.
10. Knape & Vogt, Grand Rapids, MI.
11. (Lamp) Sugatsune America, Inc. Carson, CA..
12. Mepla Inc., High Point NC.
13. Outwater Plastic Industries Inc., Woodridge NY.
14. Stanley Hardware, New Britain CT.
15. Waterloo Furniture Components, Ontario Canada.

B. Door and drawer pulls: Staple-shape wire pull, 4 inches long, solid brass with US26D, brushed chrome finish, with one-inch finger clearance.

C. Locks:
1. General:
   a. Provide at least three keys per keyed alike group.
   b. Finish: lock plug finish “nickel”.
2. Locks for drawers and doors: deadbolt type.

D. Catches: Magnetic.

E. Casework hinges:
1. Casework hinges: five knuckle institutional, offset type for all swinging doors. Hinges shall be 2-1/2" long. Hinges are mounted with flathead screws, so applied to cabinets to withstand a weight load of 150 pounds minimum. Hinge finish: satin stainless steel.
   a. Number of hinges:
      1) Doors 48 inches and less in height: 2 hinges.
      2) Doors over 48 inches in height: 3 hinges.

F. Pad silencers for doors: 10 mm (3/8 inch) diameter, self-adhesive resilient plastic or nylon buttons, at least 2 per door, in clear color.

G. Drawer Slides (provide one pair per drawer except as noted otherwise):
1. For heavy loads: Full extension type, 150 pounds per pair minimum rated capacity (for drawers over 30 inches, provide 175 pounds rated capacity), steel ball bearing rollers, drawer hold in feature.
   a. Acceptable slides, include the following, or approved equal:
      1) For drawers up to 24 inches wide:
         a) Accuride Nº. 4032.
         b) Knape and Vogt Nº. 8500.
         c) Häfele Nº. 4034.

2) For drawers over 24 inches and up to 30 inches wide:
   a) Accuride Nº. 4032.
   b) Knape and Vogt Nº. 8500.
   c) Häfele Nº. No equal.
3) For drawers over 30 inches wide:
   a) Accuride Nº. 4437.
   b) Knape and Vogt Nº. 8520.
   c) Häfele Nº. No equal.

b. Finish: clear lacquered zinc.

2. For desk and casework drawers (excluding file drawers): Full extension type, 100 pounds per pair minimum rated capacity, steel ball bearing rollers, lever disconnect, drawer hold in detent feature.
   a. Acceptable slides, include the following, or approved equal:
      1) Accuride Nº. 3832A
      2) Accuride Nº. 3832C
      3) Knape and Vogt Nº. 8400.
      4) Häfele Nº. 3832.
      5) Häfele Nº. 432.23.950.
   b. Finish: clear lacquered zinc.

H. Shelf supports.
   1. Shelf pins for laminated shelving, and wood shelving: plug-in type for 5mm diameter hole, Häfele model number 282.11.710 cast zinc alloy with nickel plated finish and recessed seat.
   2. Double slot standards with brackets:
      a. Standards 1-1/4 inch wide by 1/2 inch high steel standards with 1 inch centers for shelf supports, brushed chrome plate finish, of lengths required for conditions applied, equal to Knape & Vogt model Nº. 85 steel standards.
      b. Brackets: Knape & Vogt model Nº. 185 ANO.
   3. Single slot standards with heavy load brackets:
      a. Standards 7/8 inch wide by 11/16 inch high 12 gage steel standards with 2 inch centers for shelf supports, brushed chrome plate finish, of lengths required for conditions applied, equal to Knape & Vogt model Nº. 87 steel standards.
      b. Brackets: Knape & Vogt model Nº. 187LL ANO with cam lock lever.

I. Wire management grommets and covers: 2 inch diameter, as manufactured by Doug Mockett & Company, Manhattan Beach CA., model number " MM3 with 3A cover" or approved equal.

1. Grommet Finish: Provide in metallic finish selected by Engineer from Manufacturer's standard finishes.
2. Locations: Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
   a. For counters 6 feet or less provide 2 wire grommets and covers.
   b. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.

J. Wire management conduit and receptacle system: Medium voltage wire conduit system as manufactured by the Wiremold Company, West Hartford CT.

2.06 ACCESSORIES

A. PVC Edging for plastic laminate casework:
   1. Manufactured by The Cloverdale Company (Band-it Brand), Cloverdale VA., or equal.
   2. Thickness: 2mm thick for door and drawer edges; 1mm for exposed edges of casework bodies.
   3. Edges: Square.
   4. Custom colors to match plastic laminate colors.

B. Edging for adjustable shelving: Flexible PVC tee moulding, having equal to Outwater Plastics, Woodridge NJ., in color as selected by Engineer.

C. Glue for lamination and fabrication of wood and plywood items: Exterior Grade, phenolic resin glue.

D. Sealant, for joints between countertops and dissimilar materials: One component acetoxy silicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ±25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Engineer.
   1. Only use sealant and primers that comply with the following limits for VOC content:
      a. Architectural Sealants: 250 g/L.
      b. Sealant primer: 250 g/L
   2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
   3. Subject to requirements specified herein, the following products are acceptable, or approved equal:
      a. Dow Corning Corporation, Midland MI; product, "786".

b. General Electric Company, Waterford NY; product, “Sanitary 1700”.

c. Sonneborn Building Products Inc., Minneapolis MN; product, “Sonolastic - OmniPlus”.

d. Tremco, Beachwood OH; product, “Proglaze”.

E. Fasteners:

1. Concealed joint fasteners: Threaded steel.

2. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.

2.07 FABRICATION - GENERAL

A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Engineer.

B. Coordinate the fabrication of casework with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the casework surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the casework.

C. Shop assemble custom casework for delivery to site. Deliver in assemblies as large as possible for entrance into the designated areas. Provide for concealed job connections of adjacent units.

D. Prepare woodwork in the shop for all necessary electrical installations.

E. Fabricate, install and finish all work so that both sides of countertops, panels, doors, shelves and other casework are of balanced construction, to prevent warping.

F. Cap exposed plywood, and particle board edges with solid hardwood, matching color of wood veneer panels. Apply veneer over hardwood edging in manner to show no visible lines between wood veneer and hardwood edging.

G. Fit corners and joints hairline, secure with concealed fasteners.

H. Finish all solid wood and plywood surfaces smooth, and free from all machine and tool marks that will show through the wood veneer or facing materials.

I. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point.

J. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.

K. Finished work shall be free from visible adhesive and pencil marks.

## 2.08 FABRICATION - CASEWORK

A. Fabricate casework in accordance with requirements of specified AWI Grade and the following additional requirements:

1. Cabinets shall be in flush overlay construction, with drawer fronts and hinged doors overlapping openings a minimum of 1/4 inch all four sides.
2. Fabricate all casework scheduled for veneer finish with exposed to view grain of wood vertical or horizontal as indicated on Drawings.
3. Fabricate cabinets in integral units, each completely enclosed, without the use of common partitions.
4. Drawers:
   a. Drawer sides and backs 1/2 inch thick solid hardwood of specified species.
   b. Wood veneer drawer fronts: body panel 1/2 inch thick solid hardwood of specified species, face panel same construction as specified for cabinet doors with matching veneer. Drawer fronts shall be applied to separate drawer body component sub-front.
   c. Drawer bottoms (wood veneer casework): 1/4 inch thick hardwood veneer panel housed and glued into front, sides and back.
   d. Underside of drawer to receive continuous hot melt glue at joint between bottom and back/sides/front for sealing and rigidity.
   e. Reinforce drawer bottoms as required with intermediate spreaders.
5. Doors: Square edge design, 3/4 inch thick, without any profiling and shall fully overlap the cabinet frame.
   a. Wood veneer doors: Fabricate doors with particle board core and front and rear faces grade AA wood veneer, and solid wood edging.
   b. Maintain a maximum 1/8" reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
6. Base cabinets: Provide full horizontal top frame with glued and doweled joints, 3/4 inch plywood end panels and bottom. Bottom shall be glued and doweled and let into routed end panels. Provide 4 inch high toe rail, securely screwed to the end panels and to the bottom panel by concealed glue blocks.
7. Wall cabinets: Provide same finishes as base cabinets, with 3/4 inch thick top and bottom veneered plywood panels. Top and bottom panels shall be glued and doweled and let into routed end panels. Back of case shall be recessed and let into routed end panels and further secured with glue blocks.
8. Door and drawer spreaders: Provide minimum 3/4 thick full width cabinet body spreaders immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, and close off reveal. Front edge to be match face of adjacent cabinet doors/drawers.

2.09 SHOP APPLIED FINISHING

A. Transparent exposed-to-view finish for casework: AWI Premium Grade Factory Finish System "Conversion Varnish" system having a Medium rubbed effect with a sheen of 24° to 28° gloss units per ASTM D523. Finish system shall not substantially increase flame spread.

1. One washcoat, reduced conversion varnish.
2. Colorant: None - natural finish.
3. One coat sealer, conversion varnish.
4. Two coats topcoat: Conversion varnish equal to Sherwin Williams product "V84 series Kem Var".

B. Concealed surfaces: Thoroughly coat all concealed surfaces of finish woodwork before assembling with two coats of clear wood preservative.

C. Field Touch-up: Shall be the responsibility of the installing Construction Manager and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
2. Examine pre-fabricated woodwork before installation and verify that back priming has been completed and all packing has been removed.
3. Beginning of installation means acceptance of existing substrate and project conditions.

3.02 PREPARATION

A. Before installing work under this section, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.

B. Protect other Work against undue soilage and damage by the exercise of reasonable care and precautions. Clean, repair, or replace any work so damaged and soiled to the acceptance of the Engineer.

3.03 INSTALLATION - GENERAL

A. Install work in accordance with the latest AWI quality standards in grade specified herein, under the Article entitled "QUALITY ASSURANCE".

B. Woodwork shall be installed plumb, level, true and straight without distortions.

1. Use concealed shims as required
2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
3. There shall be no variations in flushness of adjoining surfaces.

C. Tops and Woodwork shall be scribed and trimmed to fit adjoining work.

1. Where cuts occur, refinish surfaces and repair damaged finishes

D. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.

1. Secure woodwork to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.
2. Use thin gauge finishing nails for exposed nailing, countersunk and filled flush with woodwork finished surface.
   a. Match final finish materials where transparent finish is indicated.

3.04 INSTALLATION – CASEWORK AND COUTERTOPS

A. Install casework without distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.

B. Adjust casework hardware centering the doors and drawers in the openings, and provide unencumbered operation.

C. Complete the installation of hardware and accessory items as indicated.

D. Maintain veneer sequence matching of casework with transparent finish, where so manufactured.

E. Tops: Anchor tops securely to base units and to other support systems as required.

F. After installation and leveling of cabinets and countertops have been completed; apply a continuous bead of Sealant Type SM to all joints which abut walls or partitions. Tool the sealant to a uniformly dense surface, level with the edges of the casework. Immediately remove all excess sealant from surfaces of the casework.

3.05 FIELD FINISHING

A. Except where expressly noted otherwise on Drawings, shop finish all woodwork. Where field finishing is indicated or scheduled on Drawings, finishing Work shall be as specified under Section 09 91 00 - PAINTING.

## 3.06 TOLERANCES

A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

## 3.07 ADJUSTING

A. To whatever extent work was not completed at shop or prior to installation of woodwork, perform and complete the specified finishing of woodwork.

B. Repair damaged and defective woodwork where possible eliminating defects functionally and visually.

1. Where not possible to repair damaged or defective work, replace with matching new work.
2. Adjust joinery for uniform appearance.

C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

## 3.08 CLEANING

A. Daily clean work areas by sweeping and disposing of scraps and sawdust.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area leave area in broom-clean condition.

C. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

D. Remove protective material from pre-finished surfaces, immediately prior to Final Acceptance.

E. Carefully clean exposed and semi-exposed wood surfaces, in strict accordance with fabricator's instructions. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.

F. Wash down plastic laminate with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

G. Clean and polish hardware, and bright metal trim components.

## 3.09 PROTECTION

A. Protect installed woodwork and maintain specified conditions, in a manner acceptable to both fabricator and installer. Ensure that work of this Section will not be damaged or soiled, and is completely free of defects at the time of final acceptance of Project by the Engineer.

END OF SECTION

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SECTION 06 61 16

SOLID SURFACING FABRICATIONS

## PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install solid surfacing (solid polymer) fabrications, including but not limited to the following:

1. Solid surfacing countertops and backsplashes.
2. Sealant for joints between countertops, backsplashes and abutting surfaces.
3. Brackets and fasteners as needed.

1.02 RELATED REQUIREMENTS

A. Section 12 35 30 - MANUFACTURED CASEWORK: Cabinetry, shelving and other shop fabricated casework.

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data. Identify available colors, shades, and gloss
2. Shop drawings: Large scale design details of minimum 1-1/2 inch-to-1 foot scale, showing abutting materials, installation conditions, clearances. Show profiles, jointing and fastening methods.
3. Selection samples:
   a. Solid surfacing samples for initial color selection by Engineer.
   b. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Engineer.
   c. Provide additional samples as requested by Engineer for initial selection of material colors and finishes.
4. Verification samples:
   a. 12 by 12 inch samples of solid surfacing materials.

1.04 QUALITY ASSURANCE

A. Fabricator and Installer; with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1. Fabricator and Installer for solid surfacing products shall be trained and certified by solid surfacing manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Concrete, masonry, plaster, tile setting, and other wet work shall be completed and dry before delivery, storage and installation of fabricated solid surface items.

B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

C. Sequence deliveries to avoid delays and to minimize on-site storage.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of solid surfacing fabrications; maintain temperature until Owner's Final Acceptance.

1.07 FIELD MEASUREMENTS

A. Field dimensions: The fabricator is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.

1. The Contractor shall acknowledge the fabricator's need for accurate field dimensions prior to custom fabrication.
2. The Contractor and the fabricator shall cooperate to establish and maintain these field dimensions.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on E.I. du Point Nemours & Co., Inc., Wilmington DE product "Corian".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. E. I. du Pont de Nemours and Company, Inc., Wilmington DE, product: "Corian".
2. Aristec Acrylics LLC (Avonite Surfaces), Florence, KY, product: "Avonite".

3. LG Hausys, Atlanta, GA, product “HI-MACS, Classics”.
4. Formica Corporation, Cincinnati, OH, product: “Solid Surfacing”.
5. Wilsonart International, Inc. Temple TX, product: “Gibraltar”.

## 2.02 SOLID SURFACING MATERIALS

A. Polymer solid surfacing material: Non-porous surfacing material homogeneously composed of natural minerals and high-performance polymer, fabricated sizes and profiles as shown on the Drawings, in colors and finishes as selected by Engineer.
   1. Solid surfacing material shall be NSF (National Sanitation Foundation) listed under publication 51 - Plastic Materials and Components used in Food Equipment and bear the “component” mark.
   2. Colors and patterns shall be as selected by the Engineer.
      a. Basis of design colors shall be as selected from Corian “Price Group 1-7” or approved equal.
   3. Complies with requirements of ANSI Z124.3, Type 6 and WW-P-541E/GEN.
   4. Seaming/Jointing: Structural two-part joint adhesive to form smooth and inconspicuous seam, without voids.

B. Sheet thicknesses shall be as specified below or as otherwise indicated on Drawings.
   1. Countertops: One piece monolithic design 1/2 inch thick.
   2. Countertop edges: Double-rounded edges, using 1/2 inch build-up strip adhered to countertop with joint adhesive. Top and bottom edges shall be routed using 1/2 inch round-over bit.
   3. Backsplashes: 1/2 inch thick in locations and heights as shown on the Drawings.
   4. Plywood backing: 1/2 inch thick APA C-C PLUGGED EXT, fir plywood, sanded

C. Adhesive for build-up of solid surfacing sheets: color matched two-component seam adhesive as provided by solid surfacing manufacturer.

D. Adhesive for installation of trim components, neoprene panel adhesive or structural silicone glazing sealant, as recommended by solid surfacing manufacturer.

## 2.03 ACCESSORIES

A. Counter support brackets:
   1. Construction: Fabricated from horizontal aluminum T section and vertical aluminum L section. Vertical leg designed to attach to side of supporting stud and be concealed by gypsum board or other wall finish. Alternative manufacturers provide equivalent sized steel T-sections and shop finishing.
      a. Bracket sizes:
         1) For up to 18 inch deep counters: 12 by 12 inch length legs

2) For up to 24 inch deep counters: 18 by 18 inch length legs.
3) For up to 30 inch deep counters: 18 inch vertical leg and 24 inch length horizontal leg.

2. Basis of Design: Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA.
   a. Acceptable Manufacturers/products, or approved equal:
      1) Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA, with powder coat finish.
      2) Outwater LLC., Woodridge NY. "South Carolina" Series: CSBxx-SC-CRS with powder coat finish.
      3) Federal Brace, Belmont NC., model "Streamline Countertop Bracket (steel).
3. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory/shop finished with:
   a. Electrostatically applied, powder paint coating complying with AAMA 2603 (minimum), in color selected by Architect from manufacturer's full range.

B. Sealant, for joints between countertops and dissimilar materials: One component acetoxy silicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ±25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Engineer, equal to one of the following:
   1. Dow Corning Corporation, Midland MI; product, "786".
   2. General Electric Company, Waterford NY; product, "Sanitary 1700".
   3. Sonneborn Building Products Inc., Minneapolis MN; product, "Sonolastic - OmniPlus".
   4. Tremco, Beachwood OH; product, "Proglaze".

C. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.

D. Fir plywood for backing: EWA C-C PLUGGED EXT.

E. Concealed supports for edge and corner backing shall be kiln dried birch or poplar.

## 2.04 FABRICATION

A. Coordinate the fabrication of solid surfacing products with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the countertop surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the countertops.

B. Shop fabricate all solid surfacing items in strict accordance with the details on the Drawings, the approved shop drawings, and recommendations of the solid surfacing manufacturer

1. Prepare countertops for undermount design sinks furnished and installed under Division 22 - PLUMBING.
2. Prepare solid surfacing fabrications for installation of plumbing fixtures.

C. Fit corners and joints hairline. Make all field joints and miters tight, secure with concealed fasteners.

D. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.

E. Route all edges to be butted for a smooth, clean fit. Sand edges with 120 grit sandpaper to rough up surfaces for adhesive bonding. Clean with denatured alcohol.

F. Prepare and apply adhesive in compliance with manufacturer's written instructions. Clamp all components using manufacturer's approved clamping methods at all joints and build-up laminations, maintain clamping until adhesive is set. Avoid over-tightening clamps and squeezing out adhesive.

G. Remove excess adhesive when dry with router. Follow with belt sander using 120 grit, diagonal to joint. After adhesive is leveled and smooth with surface, proceed with final shaping and finishing.

H. After shaping, smooth finish of cut surfaces equal to manufacturer's original finish. Sand surfaces smooth with wet 400 grit sandpaper. Remove superficial scratches and sander markings, buff with nylon buffing pads as recommended by solid surfacing manufacturer. Wipe surfaces clean and dry with cloths.

I. Finished work shall be free from visible adhesive and pencil marks.

J. Field touch-up: Shall be the responsibility of the installer and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

## PART 3 - EXECUTION

### 3.01 INSTALLATION - GENERAL

A. General: Install work in accordance with manufacturer's instructions.

B. Solid surfacing shall be installed plumb, level, true and straight without distortions:

1. Use concealed shims as required

2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
3. There shall be no variations in flushness of adjoining surfaces.

C. Tops and trim shall be scribed and trimmed to fit adjoining work.
1. Where cuts occur, refinish surfaces and repair damaged finishes

D. Secure solid surfacing fabrications to blocking directly attached to substrates.
1. Secure fabrications using concealed fasteners.
2. Anchor tops securely to base units and to other support systems as required.

E. After installation and leveling of solid surfacing fabrications has been completed; apply a continuous bead of specified sealant to all joints which abut walls or partitions. Tool the sealant to a uniformly dense surface, level with the edges of the casework. Immediately remove all excess sealant from solid surfacing surfaces.

3.02 TOLERANCES

A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.03 CLEANING

A. Daily clean work areas by sweeping and disposing of scraps.

B. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and solid surfacing manufacturers.

C. Wash down exposed surfaces with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.04 PROTECTION

A. Protect installed fabrications in a manner acceptable to fabricator and installer, which shall ensure no damage or deterioration at the time of Final acceptance of Project by the Engineer.

END OF SECTION

SECTION 06 64 00

PLASTIC PANELING

## 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. Plastic sheet paneling.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring for installing plastic paneling.

### 1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

### 1.04 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

### 1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

## 2.02 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

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. Crane Composites, Inc.
   b. Marlite.
   c. Nudo Products, Inc.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than 0.075 inch
4. Surface Finish: Smooth
5. Color: As selected by Architect from manufacturer's full range.

## 2.03 ACCESSORIES

A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners and caps as needed to conceal edges.

1. Color: As selected by Architect from manufacturer's full range.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, 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.

3.02 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.03 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install factory-laminated panels using concealed mounting splines in panel joints.

E. Install trim accessories with adhesive and fasteners. Do not fasten through panels.

F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

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SECTION 07 11 13

BITUMINOUS DAMPPROOFING

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install fluid applied bituminous dampproofing:

1. Apply over exterior of building foundation walls, below grade.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM D1227 - Emulsified Asphalt Used as a Protective Coating for Roofing.
2. ASTM D2823 - Asphalt Roof Coatings.
3. ASTM D449 - Asphalt Used in Dampproofing and Waterproofing.
4. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.
5. NRCA Roofing and Waterproofing Manual.

1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for dampproofing.
2. Manufacturer's application instructions including, joint and crack treatment, application temperature range, and any special procedures.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver and store dampproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.

B. Store all materials following manufacturer's recommended storage procedures for humidity and temperature conditions, protect materials from freezing and from high heat, flames or sparks.

1.06 ENVIRONMENTAL CONDITIONS

A. Do not apply when ambient temperatures may fall below 35 degrees Fahrenheit for 24 hours before and during application and until membrane has cured.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate and schedule the work of this Section with the related work of Section 03 30 00 – CAST-IN-PLACE CONCRETE, in a manner so as not to delay the smooth progress of the Work.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following or approved equal:

1. Karnak Corporation, Clark NJ, product "100 Non-Fibered Emulsion Dampproofing".
2. Henry Company, El Segundo, CA, product "788 Non-Fibered Asphalt Emulsion Dampproofing".
3. BASF Corporation Construction Systems, Shakopee, MN, product "MasterSeal 600 Series".

2.02 MATERIALS

B. Dampproofing at below grade foundation walls: Non-fibered, non-asbestos, bituminous compound comprised of asphalt, emulsifiers and clay fillers equal to Karnak Product: "No. 100" complying with ASTM D 1227 Type I, II or III suiting application method used complying with the following physical properties:

1. Weight per gallon: 8.5 pounds.
2. Solids by weight: 52 percent (nominal).
3. Solids by volume: 49 percent (nominal).
4. Permeance: 0.5 metric perms.
5. Service temperature: -5 degrees F to 180 degrees F.

C. Accessories:

1. Protection board: 1.0 pound per cubic foot density, 1 inch thick expanded polystyrene protection board.
2. Crack filler: As recommended by the dampproofing manufacturer.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Verify items which penetrate surfaces to receive dampproofing are rigidly installed.
2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.

B. Notify the Contractor if substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 03 30 00 – CAST-IN-PLACE CONCRETE or Section 04 20 00 - UNIT MASONRY. Do not proceed until patching is completed.

C. Do not apply dampproofing to damp, frozen, dirty, dusty or surfaces unacceptable to dampproofing manufacturer.

D. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 PREPARATION

A. Perform all preparation work on receiving surfaces as required, including removal of fins, scaling, and projecting rough spots, and removal of all loose mortar, dirt, oil, and other foreign matter from the substrate.

B. Protect adjacent surfaces not designated to receive dampproofing.

C. Cracks and joints in substrate surface must be properly sealed as recommended by the dampproofing manufacturer.

3.03 APPLICATION

A. Perform the application of the dampproofing in strict accordance with the manufacturer's installation instructions, and as specified herein.

B. Apply primer when so required by manufacturer's instructions.

C. Trowel, spray or brush apply as applicable to specified product, in one coat leaving no pinholes, defects or undercoated areas. Apply at coverage rate recommended by the manufacturer but not less than 4 to 6 gallons per 100 square feet.

D. After application of dampproofing is completed, carefully inspect the entire dampproofed surface for defects therein and patch all defects discovered.

3.04 PROTECTION

A. Protect dampproofing film and allow to cure for at least 48 hours before backfilling.

END OF SECTION

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SECTION 07 13 53

ELASTOMERIC SHEET WATERPROOFING

## PART 1 – GENERAL

1.01 SUMMARY

A. The work of this Section consists of waterproofing system(s) where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.

B. Furnish and install the following:

1. Adhered vertical waterproofing: Self-adhesive sheet membrane vertical waterproofing applied to surfaces at exterior construction where indicated.

C. Factory representative field inspections of installed waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 07 26 00 - VAPOR RETARDERS: Below slab vapor barrier.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ACI 515 - Guide to the Use of Waterproofing, Dampproofing, and Protective and Decorative Barrier Systems for Concrete.
2. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
3. ASTM C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
4. ASTM C 898 Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Separate Wearing Course.
5. ASTM D 146 - Sampling and Testing Felted and Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing and Roofing.
6. ASTM D 412 - Standard Test Methods for Rubber Properties in Tension.
7. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
8. ASTM D 1079 - Standard Terminology Relating to Roofing and Waterproofing.
9. ASTM D 1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.

10. ASTM D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel).
11. ASTM D-1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
12. ASTM D-3767 - Standard Practice for Rubber - Measurements of Dimensions.
13. ASTM D 3787 - Test Method for Bursting Strength of Knitted Goods: Constant Rate of Traverse (CRT), Ball Burst Test.
14. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
15. ASTM D 5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
16. ASTM E 96 - Tests for Water Vapor Transmission of Materials in Sheet Form.
17. ASTM E 154 - Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. International Concrete Repair Institute (ICRI) Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion.
2. International Concrete Repair Institute (ICRI) Technical Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

C. Definitions:

1. "Low Temperature": The term "Low Temperature" is used herein for purposes of defining selection of appropriate waterproofing products which are manufactured for use in a specific temperate range. "Low Temperature" products are appropriate in ambient and substrate conditions which are below 40º F. (5º C.) and above 25º F. (-4º C.).

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 19.23 – CONSTRUCTION MEETINGS. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner, Engineer, Contractor, Waterproofing Applicator's Project Superintendent, waterproofing manufacturer's technical representative and representatives of other related trades as directed by the Engineer or Contractor.
2. Agenda:
    a. Scheduling of waterproofing operations.
    b. Review of staging and material storage locations.
    c. Coordination of work by other trades.
    d. Protection of completed waterproofing.
    e. Establish weather and working temperature conditions to which Engineer and Contractor must agree.
    f. Emergency rain protection procedure.
    g. Establish conditions for which a temporary waterproofing will be provided by the Contractor.
    h. Mock-up requirements.
    i. Substrate conditions, and procedures for substrate preparation and waterproofing installation.
    j. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

C. Sequencing: Coordinate the work of this Section with the respective trades responsible for installing work concealed by waterproofing.
    1. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:
    1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties.
    2. Shop Drawings:
        a. Provide large scale details of all termination and transition details, penetrations.
    3. Verification Samples:
        a. 24 by 24 inch samples of sheet membrane waterproofing.
    4. Test and Evaluation Reports: Submit manufacturer's test reports of in-place testing performed by an independent testing agency.

5. Manufacturer's Pre-Warranty Certification: Manufacturer's written certification that shop drawings and proposed systems and components have been reviewed and accepted by the manufacturer for the specified manufacturer's warranty.
6. Manufacturer's Instructions: Manufacturer's application instructions including data for surface conditioners, joint and crack treatment and application temperature range.
7. Applicator Reports:
    a. Review statement: Written statement, signed by the waterproofing applicator, stating that the Contract Drawings have been completely reviewed with an agent of the waterproofing system manufacturer; accompanied by a written statement from the manufacturer that the selected sheet membrane waterproofing system is proper, compatible, and adequate for the application shown.
        1) The waterproofing applicator will notify the Engineer and Owner in writing that the as-built field conditions when exposed are in conflict with the Contract Documents for the proper application of the selected waterproofing system or the warranty requirements.
2. Manufacturer Reports: Submit manufacturer's representative's field inspections reports.
3. Qualification Submittals:
    b. Workmen Qualifications: Statement of qualifications for on-site supervisor, as required under the Article entitled "Quality Assurance" specified herein below, include certifications of workers who have completed an installation training program.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT.
    1. Bonds and Warranty Documentation: Manufacturer's and Applicator's warranties, include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

## 1.06 QUALITY ASSURANCE

A. General: Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.
    1. Field Supervised Work: Contractor shall notify Engineer before beginning work of this Section. Obtain Engineer's approval of Contractor's procedures before proceeding with the work.

B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of waterproofing system.

C. Manufacturer’s On-site Inspections: Make arrangements to have Manufacturer’s representative (employed by manufacturer) be present on-site during the Work of this Section at key points, which include, but are not limited to:

1. Pre-installation conference.
2. Review of installation procedures (a minimum of 1 site visit is required).

D. Preconstruction Testing: Applicator’s review statement that in-situ conditions are acceptable for application of waterproofing system.

## 1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Deliver and store waterproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. General: Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
   a. Store all materials in an elevated, dry location, protected by waterproof coverings.
   b. Protect materials from freezing.
   c. Store liquid products in a well ventilated area having a minimum ambient temperature of 40 degrees Fahrenheit and a maximum of 80 degrees Fahrenheit. Protect primers, mastic and adhesives from high heat, flames or sparks.
3. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle.

C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Engineer specifically authorizes correction thereof and usage on project.

## 1.08 SITE CONDITIONS

A. Maintain ambient temperatures above 40 degrees Fahrenheit for 24 hours before and during application and until liquid or mastic accessories have cured.

1.09 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

B. Manufacturer's Warranty: Provide 5 year Manufacturer's warranty which shall include replacement of defective materials.

C. Special Warranty: Provide 3 year Applicator's warranty or performance bond which shall include removal and replacement of defective materials, and repairs or replacement of Owner's materials and products damaged due to failure of waterproofing installation to resist water or moisture penetration

D. Extended Correction Period: Membrane waterproofing shall be guaranteed for 3 years with the Contractor or water-proofing Subcontractor agreeing to repair or replace work which leaks or otherwise fails to perform as required due to failures of materials or workmanship. This shall include the removal and replacement of any work which conceals the membrane work.

**PART 2 - PRODUCTS**

2.02 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Henry Company, El Segundo CA., ("Henry").
2. Carlisle Coatings and Waterproofing, Inc., Wylie, TX., ("Carlisle").
3. W.R. Grace & Co., Cambridge MA., ("Grace").
4. Polyguard Products Inc. Ennis, TX., ("Polyguard").
5. W.R. Meadows, Hampshire, IL., ("Meadows").

2.03 ADHERED VERTICAL WATERPROOFING

A. Basis of Design (Specified Product): Henry Company, El Segundo CA., ("Henry"), product: "Blueskin WP 200".

1. Acceptable Manufacturers/Products: Subject to compliance with the requirements specified herein, similar sheet waterproofing products include the following:

a. Henry, product "Blueskin WP 200".
b. Carlisle, product "MiraDri 860/861".
c. Grace, product "Bituthene 3000".
d. Polyguard, product "Polyguard Underseal PRM".
e. Meadows, product "Mel-Rol".

B. Sheet membrane: Prefabricated composite sheet, minimum of 60 mils thick, consisting of 56 mils thickness of rubberized asphalt and 4 mils thick cross-laminated polyethylene film, self-adhering after removal of release paper, and furnished in 36 or 48 inch wide rolls, formulated for anticipated ambient temperature, and meeting or exceeding the specified physical properties.

C. Waterproofing Membrane Physical Properties:

1. Flexibility: Unaffected when tested by ASTM D 1970 at -25 degrees F.
2. Tensile strength for membrane, as per ASTM D 412, modified: 300 pounds per square inch, minimum.
3. Tensile strength for film, as per ASTM D 412, modified: 5,000 pounds per square inch, minimum.
4. Elongation, as per ASTM D 412, modified: 300 percent, minimum.
5. Cycling over crack at minus 25 degrees Fahrenheit: No effect at 100 cycles.
6. Peel adhesion, when tested per ASTM D 903 (modified) for 7 days dry at 70 degrees Fahrenheit and 120 degrees Fahrenheit and for 7 days wet at 70 degrees Fahrenheit: 7.5 pounds per inch width, minimum.
7. Puncture resistance for membrane, (ASTM E 154): 40 pounds, minimum.
8. Resistance to hydrostatic head of water when tested per ASTM D 5385: 200 feet of water, minimum.
9. Exposure to fungi in soil for 16 weeks, as per GSA-PBS 07111: Unaffected.
10. Permeance as per ASTM E 96, Method B: 0.05 perms (grains/sq. ft./hr./in. Hg), maximum.
11. Water absorption, as per ASTM D 570: 0.2 percent by weight, maximum.

D. Primer: Rubber based low VOC content primer formulated with high solids content which shall comply with regulatory VOC requirements.

1. Henry:
   a. Conventional use: Aquatac.
   b. Low temperature: Blue Skin Adhesive.
   c. Green or damp concrete: No available product.
2. Carlisle:
   a. Conventional use: CCW-702.
   b. Low temperature: CCW-702LT.
   c. Green or damp concrete: CCW-715.
3. Grace:
   a. Conventional use: WP-3000.
   b. Low temperature: B2.
   c. Green or damp concrete: B2.

4. Polyguard:
    a. Conventional use: “Polyguard 650 LT Liquid Adhesive” or “Polyguard California Sealant”.
    b. Low temperature: “Polyguard 650 LT Liquid Adhesive”.
    c. Green or damp concrete: No available product.
5. Meadows:
    a. Conventional use: Mel-Prime.
    b. Low temperature: Mel-Prime VOC.
    c. Green or damp concrete: No available product.

2.04 ACCESSORIES

A. Primers, Sealants, crack filler, mastics, liquid detailing compound, tape, and adhesives: As recommended by the waterproofing manufacturer.
    1. Primer, as recommended for substrate conditions by waterproofing manufacturer: Rubber based low VOC content primer formulated with high solids content which shall comply with regulatory VOC requirements.

**PART 3 - EXECUTION**

3.02 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
    1. Verify items which penetrate surfaces to receive waterproofing are rigidly installed.
    2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
    3. Beginning of installation means acceptance of substrate and project conditions.

B. Evaluation and Assessment:
    1. Do not apply waterproofing to damp, frozen, dirty, dusty or surfaces unacceptable to membrane manufacturer.

3.03 PREPARATION

A. Protection of In-situ Conditions: During the operation of work of this Section, protect finished materials and products against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all materials which are soiled or otherwise damaged by Work of this Section. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match.

B. Cracks and joints in substrate surface must be properly sealed with joint filler and sealant as recommended by the sheet membrane waterproofing manufacturer.

## 3.04 INSTALLATION – GENERAL

A. Apply waterproofing system in strict accordance the manufacturer's installation specifications, Contract Document details, approved shop drawings and the recommendations of Manufacturer's on-site technical representative, and as additionally specified herein.

## 3.05 INSTALLATION - ADHERED VERTICAL WATERPROOFING

A. Primer: Where sheet membrane is to be applied, apply primer as recommended by manufacturer at a rate of 250 to 350 square feet per gallon; areas not covered with membrane in 24 hours must be reconditioned.

B. General: Perform the application of the sheet membrane waterproofing system in strict accordance with the manufacturer's installation specifications, details, and recommendations, and as specified herein.

1. At all external and internal corners, apply a continuous strip of sheet membrane, at least 12 inches wide, centered on the axis of the corner, before the general application of the membrane.
2. Apply 8 inch wide strips of the sheet membrane over all cracks greater than 1/16 inch in width.
3. Apply a double layer of the sheet membrane around all penetrations in the surface. Apply a bead of compatible sealant between the top layer of membrane and the clamping rings of penetrating items and at all terminations.
4. Apply the sheet membrane in strips of 8 feet in length or less, overlapping edge seams at least 2-1/2 inches. Stagger all end laps. Roll the entire surface of the membrane firmly and completely, as soon as possible after application thereof. Seal all tee joints at the end of each working day. Seal all daily terminations, and permanent terminations with manufacturer's recommended sealant material.

C. After application of membrane is completed, carefully inspect the entire waterproofed surface for defects therein. Patch tears and inadequately lapped seams with membrane material. Slit fishmouths, repair with a patch extending at least 6 inches in all directions from the slit, and seal all edges of the patch with manufacturer's recommended sealant.

D. Arrange for inspection of waterproofing system by representative of waterproofing manufacturer, prior to installation of insulation and backfill. Schedule and sequence manufacturer's inspection in manner to prevent delays in construction schedule.

## 3.06 FIELD QUALITY CONTROL

A. Manufacturer Services: Submit to Engineer manufacturer's final acceptance report following inspection of installed waterproofing within 14 calendar days following inspection.

3.07 CLEANING

A. Clean all finished surfaces which have been damaged by the work of this Section.

3.08 PROTECTION

A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

## 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. Molded (expanded) polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Mineral-wool blanket insulation.

B. Related Requirements:

1. Section 07 21 19 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.

### 1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Molded (expanded) polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Mineral-wool blanket insulation.

### 1.04 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

# PART 2 - PRODUCTS

## 2.01 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Molded (Expanded) Polystyrene Board Insulation, Type IX: ASTM C578, Type IX, 25-psi minimum compressive strength.

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. Atlas Roofing Corporation - MPS.
b. Insulfoam; Carlisle Construction Materials Company.
c. Plymouth Foam, Inc.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

## 2.02 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type IA (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

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. Johns Manville; a Berkshire Hathaway company.
b. Rockwool International.
c. Thermafiber, Inc.; an Owens Corning company.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.03 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

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. AGM Industries, Inc.
b. Gemco.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

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. Gemco.

2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- 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. 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. AGM Industries, Inc.
b. Gemco.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

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. AGM Industries, Inc.
b. Gemco.

2.04 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

## 3.03 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

## 3.04 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.
3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

## 3.05 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.06 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. 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

SECTION 07 21 19

FOAMED-IN-PLACE INSULATION

## 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. Closed-cell spray polyurethane foam.

B. Related Requirements:

1. Section 07 21 00 "Thermal Insulation" for foam-plastic board insulation.

### 1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES

### 1.05 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## PART 2 - PRODUCTS

### 2.01 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BASF Corporation.
   b. Icynene-Lapolla; Icynene.
   c. Johns Manville; a Berkshire Hathaway company.

2. Surface-Burning Characteristics: Comply with ASTM E84; 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: 450 or less.

3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

### 2.02 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

### 3.02 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Cavity Walls: Install into cavities to thickness indicated on Drawings.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.03 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

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SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Underslab Vapor Retarders

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.01 UNDER SLAB VAPOR BARRIERS:

A. Manufacturers and products:

1. Specified Product (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Raven Industries, Sioux Falls, SD, Product: “VaporBlock Plus VBP20”.

2. Acceptable manufacturers: Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, but are not limited to, the following:

a. Raven Industries, Sioux Falls, SD, product “VaporBlock Plus VBP20”.

b. Stego Industries LLC, San Juan Capistrano, CA, product: “Stego Wrap (20 mil)”.

c. Poly-America, Grand Prairie, TX, product: “Yellow Guard (20 mil)”.

B. Vapor barrier: Seven layer co-extruded gas and moisture barrier fabricated from polyethylene and EVOH resins, Class A

C. Characteristics:

1. Minimum thickness: 20 mils.
2. Weight: 102 lbs/msf.
3. Permeance (new) when tested in accordance with ASTM E 154 (Sections 7): Less than 0.0098 perms (gr/ft$^2$/hr/in-Hg).
4. Permeance (after conditioning) when tested in accordance with ASTM E 154 (Sections 8 and 11): Less than 0.0079 perms (gr/ft$^2$/hr/in-Hg).
5. Tensile strength when tested in accordance with ASTM E 154 (Section 9): 58 lbf.
6. Impact resistance when tested in accordance with ASTM D 1709: 2,600 g.
7. Water vapor transmission rate when tested in accordance with ASTM E 96: 0.0040 grains/hr-ft$^2$.
8. Radon diffusion coefficient when tested K124/02/95: $<1.1 \times 10^{-13} m^2/s$.

2.02 ACCESSORIES:

A. General: Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each type of vapor barrier.

B. Seam Tape: High density polyethylene tape or HDPE tape as recommended by vapor barrier manufacturer, with pressure sensitive adhesive. Minimum width 4 inches.

C. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer’s instructions.

PART 3 - EXECUTION

3.01 INSTALLATION OF VAPOR RETARDERS UNDER SLAB ON GRADE

A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.

B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.

1. Extend vapor retarder vertically minimum 24 inches above top of footing.

C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

END OF SECTION

SECTION 07 27 13

MODIFIED BITUMINOUS SHEET AIR BARRIERS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

B. Related Requirements:
   1. Section 03 30 00- CAST-IN-PLACE CONCRETE: Concrete foundation work, walls and slabs.
   2. Section 04 20 00 – UNIT MASONRY: Masonry wall coordination for coordination with openings.
   3. Section 07 26 00- VAPOR RETARDERS:
      a. Vapor barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.
   4. Section 07 92 00- JOINT SEALANTS: Requirements for joint sealant and backing materials.

### 1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.

   1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

### 1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of modified bituminous sheet air barrier.

B. Product test reports.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly , 150 sq. ft. incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested according to ASTM E2357.

2.02 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. Henry Company.
c. Tremco Incorporated.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
b. Tensile Strength: Minimum 250 psi; ASTM D412, Die C.
c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
d. Puncture Resistance: Minimum 40 lbf; ASTM E154/E154M.
e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D570.
f. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method.
g. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541 as modified by ABAA.
h. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
i. UV Resistance: Can be exposed to sunlight for 30days according to manufacturer's written instructions.

## 2.03 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

# PART 3 - EXECUTION

## 3.01 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Bridge isolation joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

## 3.02 INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. When ambient and substrate temperatures range between 25 and 40 deg F install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.
2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water.
2. Roll sheets firmly to enhance adhesion to substrate.

D. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

E. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

G. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

H. Do not cover air barrier until it has been tested and inspected by testing agency.

I. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

## 3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

C. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

E. Prepare test and inspection reports.

## 3.04 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

END OF SECTION

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SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

## 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. Vapor-retarding, fluid-applied air barriers.

B. Related Requirements:

1. Section 04 20 00, “UNIT MASONRY” for coordination cmu cavity wall construction.

### 1.03 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

### 1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

### 1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

## 1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

## 1.07 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly 150 sq. ft. incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

   a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
   b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
   c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

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.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E783
3. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D4541.
4. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.010 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

## 2.02 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested according to ASTM E2357.

## 2.03 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

A. High-Build, Vapor-Retarding Air Barrier: Modified bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

1. Modified Bituminous Type:

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) Carlisle Coatings & Waterproofing Inc.
2) Henry Company.
3) Tremco Incorporated.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
b. Vapor Permeance: Maximum [0.1 perm] ASTM E96/E96M, Desiccant Method.
c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

## 2.04 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to

produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

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. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation.
c. The Dow Chemical Company.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

## 3.03 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

## 3.04 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils applied in two equal coats.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

## 3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

## 3.06 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 07 27 26

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SECTION 07 42 43

COMPOSITE WALL PANELS

## PART 1 – GENERAL

1.01 SUMMARY

A. The work of this Section consists of composite panel wall systems where shown on the Drawings, as specified herein, and as required for a complete and proper installation.

B. Furnish and install the following:

1. Rout and return metal composite faced panel system including vertical walls, fascia and horizontal soffits.
2. Related flashing adapters, copings, trim and filler components indicated as integral parts of the panel system or as designed.
3. Extruded aluminum framing, retention assemblies, anchorages, shims, furring, fasteners, gaskets, and sealant associated with the work of this Section.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 – UNIT MASONRY: Preparation of adjacent masonry work.

B. Section 05 40 00 - COLD-FORMED METAL FRAMING: Structural wall framing.

C. Section 07 21 00 - THERMAL INSULATION: Rigid insulation.

D. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Counter flashings and cap flashing at roof.

E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.

F. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS: Entrance doors, frames, vestibule and storefront framing.

1.03 REFERENCES

A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. AAMA 501 - Methods of Test for Metal Curtain Walls.
2. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
3. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and storefront, Curtains Walls and Doors.
4. ASTM E 330 Structural Performance of Exterior Entrance and storefront, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
5. ASTM E 331 - Test method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work

B. Sequencing:

1. Field Measurements:
   a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
   b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications,performance data, physical properties and installation instructions for each item furnished hereunder.
2. Shop Drawings:
   a. 1/4 inch scale elevations indicating panel jointing.
   b. Large scale design details of wall system; indicating sizes, types, and gauges of all metal components; expansion provisions, sealant details, indicating types and thickness of bracing and stabilizing members; attachment clips and brackets; and complete installation details.
   c. Design engineering shall be the responsibility of the wall systems manufacturer; details may vary from those indicated on the Contract Drawings.
3. Selection Samples:

a. Sample card indicating Manufacturer's full range of coating colors available for selection by Engineer.

b. Provide physical samples as requested by Engineer for initial selection of colors and finishes

c. Manufacturer's sample boards for sealant colors, for selections by the Engineer.

4. Verification Samples:

a. After receipt of selected standard colors from the Engineer, submit at least two 12-inch long pieces of major metal extruded components of the systems, and 12 by 12 inch samples of finished aluminum sheet used for trim components, prefinished in the specified finish system in selected colors.

5. Certificates: Indicate how design requirements for loading and other performance criteria have been satisfied.

6. Manufacturer's Instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

1. Bonds and Warranty Documentation:

a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.06 QUALITY ASSURANCE

A. General: Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Qualifications:

1. Manufacturers: Minimum of 10 years experience in manufacturing of composite wall panel systems.

2. Professional Engineer Qualifications: Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in the Commonwealth of Massachusetts

1.07 MOCKUPS

A. Provide mockup panels using approved colors, minimum 10 square feet, illustrating color and finish, and demonstrating the minimum standard for the Work.

1. Locate mock-ups where required by the Engineer.

B. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

C. Accepted mockups may not remain as part of the work; the number of mock-ups shall

not be restricted.

## 1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Engineer specifically authorizes correction thereof and usage on project.

## 1.09 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

B. Extended Correction Period: Project specific Manufacturer's written warranty for composite panel system, covering repair or replacement of any system which leaks, or exhibits defects in materials, finish, design, within 2 years from date of Project Substantial Completion. Failure due to defective materials or workmanship is deemed to include, but not to be limited to:

1. Failures in operation of operating component or components.
2. Leakage or air infiltration in excess of the specified standard.
3. Deterioration of finish to an extent visible to the unaided eye.
4. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the work of this Section or the Work as a whole.

C. Special Finish Warranty: Provide 20 year warranty on polyvinylidene flouride enamel finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on 3A Composites, Mooresville, NC, product "Alucobond Rainscreen II" system.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Mitsubishi Kasei America, Inc., Chesapeake, VA
2. 3A Composites, Mooresville, NC.
3. Alcoa Architectural Products, Eastman GA
4. Centria Architectural Systems, Moon Township, PA
5. Firestone Metal Products (Unaclad), Anoka, MN.
6. Laminators Incorporated, Hatfield PA.
7. Lymo Construction Company, Merrimack NH.
8. Universe Corporation, St. Louis MO.

### 2.02 SYSTEM DESCRIPTION

A. System General Description: Rout and return panel system with attachment system which will allow for exterior removal of any individual panel within the erected system for damage replacement or access of structure behind the panel, without disturbing adjacent panels.

1. System shall be a cavity rain screen design and provide a reveal joint as detailed on Drawings.

B. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" published by AAMA, and ANSI/AAMA 302.9 requirements for aluminum windows.

C. System shall not have visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

## 2.03 PERFORMANCE REQUIREMENTS

A. General Performance: The metal panel system including required supports, trim and sealant shall meet all regulatory requirements for wind loading, water penetration, and air leakage and in addition the following criteria.

1. Wind Loading: Panels installation shall be designed for wind loads of 20 pounds per square foot positive loading and 40 pounds per square foot negative loading.
   a. Panels shall have a deflection limit of l/175 for positive loading.
   b. Fatigue testing: Panels shall show no evidence of meal/foam interface delamination when panel is tested by simulating wind loads of 20 psf (positive and negative) for two million alternate cycles. Test results shall be verified by independent laboratory.
2. Water infiltration: Static Water Infiltration (ASTM E331-83) at 15.0 psf (77.5 mph wind and 2.88 inches $H_2O$) with a water spray rate of five (5) gallons per hour per square foot minimum for 15 minutes, no uncontrolled water infiltration on room side.
3. Static Air Infiltration (ASTM E283-84) at 10.0 psf (63.3 mph wind and 1.92 inches $H_2O$). Air infiltration shall not exceed .06 cfm per square foot for the fixed wall.
4. Wall system assemblies shall be designed to support the dead loads, live loads, wind loads, and combinations loads, positive and negative as required by the governing laws and building codes with a maximum deflection of L/175 of the unsupported span of any assembly or 3/4 inches, whichever is less when tested at 40 pound per square foot for positive and negative wind loads.
5. Design wall system, to withstand thermal expansion and contraction movements of component materials, without buckling, failure of joint seals, undue stress on members or fasteners, or other detrimental effects.

B. Fire Performance Characteristics: Provide metal composite wall systems with the following fire test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested per ASTM E 84:
   a. Flame spread index: 25 or less.
   b. Smoke developed index: 450 or less.

## 2.04 COMPOSITE PANELS

A. Materials:

1. Aluminum Sheet: Smooth surface coil-coated sheet, ASTM B209, 3005 T5 Aluminum alloy.
2. Aluminum Extrusions: ASTM B 221, 6063 T5 Aluminum.
3. Panel Core: Thermo-set polymeric core, fire-retardant per ASTM E 84, with flame-spread index of 25 or less and smoke-developed index of 450 or less.

B. Composite aluminum panels, as manufactured by one of the following, or approved equal. Panels shall be two sheets of 0.020 aluminum sandwiching a core of extruded thermoplastic formed in a continuous process with no glues or adhesives between dissimilar materials.
1. Panel Thickness: 4mm (nominal 0.157 inch).
2. Surface Texture: Smooth.
3. Bond Integrity: No failure of bond between core and faces and no cohesive failure of core when tested in accordance with ASTM D 1781 at minimum of 22.5 in-lb per inch.

C. Acceptable panels:
1. Mitsubishi Kasei America, Inc., Chesapeake, VA, product “Alpolic”.
2. 3A Composites, Mooresville, NC., product “Alucobond”.
3. Alcoa Architectural Products, Eastman GA., product “Reynobond ACM”.

## 2.05 TRACK SYSTEM

A. Aluminum Track System: Extruded aluminum ASTM B221, alloy 6063-T6 or alloy 6061-T6 track system designed for joint width indicated on the Drawings with an extruded aluminum retainer. Metal to metal sliding joints are not permitted.

## 2.06 FABRICATION

A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Engineer.

B. All panels shall be formed to specified dimension with tolerances to accommodate expansion and contraction between panels and structure members. Maintain indicated 3/4 inch deep reveal at all horizontal and vertical joints.

C. Accessory and trim components shall be factory fabricated and ready for installation.

D. Fabricate panels in a manner that will eliminate condensation on the interior side. Design joints between panels to form weathertight seals.
1. Provide factory-assembled, wall panel units fabricate d to dimensions and joint configurations indicated on Drawings.
2. Form panel lines, breaks and angles sharp and true with surfaces that are free from warp or buckle.

3. Fabricate from sharply cut edges, with no displacement of aluminum sheet or protrusion of core.
4. Tolerances shall accommodate expansion and contraction between panels and structural members. Maintain the indicated reveal depth for both horizontal and vertical joints as indicated.

E. Panel Tolerances:
1. Flatness: Maximum allowable distortion: 1/32 inch in 24 inches (0.794 mm in 600mm) in any direction.
2. Thickness: ±1/32 inch.
3. Length and Width: +0, -1/8 inch.
4. Squareness: 1/64 inch per lineal foot.

2.07 FINISHES

A. Composite Panels: Shop-applied, fully oven cured Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings, having a minimum total film thickness of 2 mils and conforming to AAMA 605.2 (latest edition), NAAMM - Metal Finishes Manual, and the following:
1. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product “Kynar 500” or Ausimont USA. product “Hylar 5000 “.
2. Finish Coating shall be manufactured as one of the following products:
   a. Glidden Company; product “Visulure.”
   b. Morton International; product “Fluoroceram CL.”
   c. PPG Industries Inc.; product “Duranar XL.”
   d. Valspar Corp., product: “Flurothane.”
3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
4. Primer: Corrosion resistant, epoxy or urethane based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 0.70 to 0.80 mil dry film thickness.
6. Top Coat: Polyvinylidene flouride enamel clear top coat averaging 0.45 to 0.55 mils dry film thickness
7. Color and Appearance: Provide up to two colors as selected by Engineer from manufacturer’s complete range of options, including colors designated by the coating manufacturer as “bright,” “premium,” “exotic,” “polychromatic,” “pearlescent,” or “metalic”.

a. Gloss: Medium, measured by ASTM D523, 35 plus or minus 5 at 60 degrees Fahrenheit.

2.08 ACCESSORIES

A. Fasteners: As recommended by manufacturer, concealed stainless steel.

B. Fittings for Attaching Panels to Sub-Structure: Proprietary, custom made aluminum extrusions and clips in fabricator's standard profiles as required for complete installation; provide continuous extrusions full length around panel perimeter for panel reinforcement and alignment; intermittent clips not acceptable.

C. Sub-girts: Steel, hot-dipped galvanized to G90 coating, designed to accommodate expansion and contraction, dynamic movements and design load requirements; provide plastic shims as thermal separator between extrusions and sub-girts.

D. Shims: Rigid plastic.

E. Flashing and miscellaneous related sheet metal fabrications: Aluminum sheet, minimum 0.040 inch (1 mm) thick, finished to match adjacent panels.

F. Flashing Tape: 4 inch (102 mm) wide self-adhering butyl flashing tape.

G. Sealant and backing materials:

1. For perimeter joints between system and abutting materials, excluding exterior metal-to-metal weather seals:. Low modulus type, Multi-component non-sagging gun-grade polyurethane sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT,M, A and O with a minimum movement capability of ±50 percent, equal to the following:Mameco International, Inc., product “Vulkem 922”.

   a. Sonneborn Building Products Inc., Minneapolis MN.; product, “Sonolastic NP2”.

   b. Tremco, Beachwood OH.; product, “Dymeric 511”.

   c. Pecora Corporation, Harleysville PA.; product “Dynatrol II”.

2. For metal to metal joints within system: One-part low modulus, moisture curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, FS TT-S-001543A, Type, Class A with a minimum movement capability of +100 percent and -50 percent, equal to the following or as otherwise recommended by manufacturer:

   a. Dow Corning Corporation, Midland MI.; product, “790”.

   b. Tremco, Beachwood OH.; product, “Spectrim 1”.

   c. General Electric Company (GE Silicones) Waterford NY.; product, “Construction 1200”.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Maximum deviation from vertical and horizontal alignment of substrate shall be no more than 1/4 inch in 20'-0".
2. Beginning of installation means acceptance of existing substrate and project conditions.

B. Evaluation and Assessment: At least two weeks prior to commencing the work of this Section, conduct a pre-installation inspection by a representative of the metal wall manufacturer at the Project site. Coordinate time of inspection to occur prior to installation of metal wall panels.

1. Any additional work resulting from pre-installation or completed installation inspections shall be provided at no additional cost to the Owner.

3.02 PREPARATION

A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

B. Verify that substrate layout complies with shop drawing layout.

C. Report any variations and potential problems to the Engineer.

D. Do not start work until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. General: Comply with manufacturer's product data including product technical bulletins, product catalog installation instructions, and product carton instructions.

B. Furring and framing: Accurately align and attach furring and framing in strict compliance with framing manufacturer’s recommendations and approved shop drawings.

1. Frame wall openings with additional framing members at perimeter of openings as needed.
2. Align holes in framing members to facilitate electrical conduit and piping work.

3. Provide all needed connections and accessories provide a complete structural system.
4. Provide all needed members for proper fastening of aluminum track for panel system.

C. Bracing: Provide bridging and bracing as recommended by manufacturer, as necessary, and as indicated on approved shop drawings. Provide kick-back bracing perpendicular to plane of framing system and securely anchored to building structure as needed to comply with specified performance requirements.

D. Install aluminum track system as recommended by manufacturer. Installed track to receive panels shall be even, smooth, sound, clean, and free from defects detrimental to panel installation.

E. Erect panels plumb, level, and true.

F. Anchor panels securely in place accordance with manufacturer's approved shop drawings.

G. Conform to panel manufacturer's instructions for installation of concealed fasteners.

H. Install sealant and backing material at all joints within panel system and perimeter of system.
1. Install joint bead back-up in all joints.
   a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
   b. Do not stretch back-up material into joints.
2. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.
3. Apply specified sealant materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.
   a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
   b. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.
   c. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
   d. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.

e. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

## 3.04 TOLERANCES

A. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

B. Erect the composite metal panel systems plumb and level, free of warp or twist.

1. Maximum misalignment of two adjoining members abutting in plane: 1/32 inch
2. Maximum variation from plumb or level: 1/16 inch per 10 feet, non cumulative
3. Maximum offset from true dimensional alignment: 1/8 inch.

## 3.05 FIELD QUALITY CONTROL

A. Non-Conforming Work: Damaged and unapproved work shall be removed and replaced.

B. Manufacturer Services: Field inspection of completed installation to be performed by a representative of the composite panel manufacturer and submit a written report.

1. Installer shall correct deficiencies noted in report and additional deficiencies identified by Engineer's observations.
2. Replace damaged panels and accessories which cannot be repaired in field.

## 3.06 CLEANING

A. General: Clean work under provisions of Section 01 74 13 – CLEANING UP.

1. Refer to AAMA 601.1 for cleaning and maintenance of panels.

B. After completion of the work of this Section:

1. Remove equipment rubbish, and debris from the work area.
2. Remove temporary protective films.
3. Clean exposed panel surfaces promptly after completion of installation in accordance with recommendations of panel and coating manufacturer.
4. Clear weep holes and drainage channels of obstructions, dirt, and sealant.
5. Leave immediate site area in rake-clean condition.
6. Protect and maintain wall system in clean condition during construction.

## 3.07 PROTECTION

A. Protect finished work under provisions of Section 01 52 13 - TEMPORARY FACILITIES.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

## 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. Manufactured reglets with counterflashing.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, and blocking.

### 1.03 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

### 1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

### 1.05 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

E. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

## 1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.

E. Sample Warranty: For special warranty.

## 1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

## 1.08 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Coordinate mock-up with other sections in order to provide the appropriate sheet metal flashing and trim to make a complete assembly for review and confirmation of the mockup.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner 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.

## 1.09 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.010 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. As-Milled Finish: Standard one-side bright

2. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

3. Color: As selected by Architect from manufacturer's full range

4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 4 (polished directional satin)

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1) Run grain of directional finishes with long dimension of each piece.

2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat

2. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

3. Color: As selected by Architect from manufacturer's full range

4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

## 2.03 UNDERLAYMENT MATERIALS

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.

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. Atlas Roofing Corporation - MPS.
   b. Intertape Polymer Group.
   c. Kirsch Building Products, LLC.

2. Source Limitations: Obtain underlayment from single source from single manufacturer.

C. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

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. Carlisle WIP Products; a brand of Carlisle Construction Materials.
   b. Henry Company.
   c. Owens Corning.
   d. Protecto Wrap Company.

2. Source Limitations: Obtain underlayment from single source from single manufacturer.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

## 2.04 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Copper, Zinc-Tin Alloy-Coated Copper, Copper-Clad Stainless Steel Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized), Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
6. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:

1. For Copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead with maximum lead content of 0.2 percent.
2. For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
3. For Zinc-Tin Alloy-Coated Copper: ASTM B32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.
4. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.
5. For Zinc: ASTM B32, 40 percent tin and 60 percent lead with low antimony, with maximum lead content of 0.2 percent, as recommended by zinc manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

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 Corporation.
   b. Hohmann & Barnard, Inc.
   c. Metal-Era, Inc.

2. Source Limitations: Obtain reglets from single source from single manufacturer.
3. Material: Stainless steel, 0.0188 inch thick
4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
8. Accessories:

   a. 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.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

9. Finish: Mill

## 2.05 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

2. 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.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

H. Do not use graphite pencils to mark metal surfaces.

## 2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF UNDERLAYMENT

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lap joints not less than 2 inches.

B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches.
2. Lap end joints not less than 12 inches.

C. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

D. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.

2. Lapp joints not less than 4 inches.

## 3.03 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and/or sealant as occurs.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel and aluminum sheet.
3. Do not pretin zinc-tin alloy-coated copper.
4. Do not use torches for soldering.
5. Heat surfaces to receive solder, and flow solder into joint.

a. Fill joint completely.
b. Completely remove flux and spatter from exposed surfaces.

6. Stainless Steel Soldering:

a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
b. Promptly remove acid-flux residue from metal after tinning and soldering.
c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

## 3.04 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

## 3.05 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of anchor and washer spaced at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

## 3.06 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

C. Reglets: Installation of reglets is specified in Section 03 30 00 "Cast-in-Place Concrete." And Section 04 20 00 "Unit Masonry."

## 3.07 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.08 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.09 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.010 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in 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, as determined by Architect.

END OF SECTION

SECTION 07 71 00

ROOF SPECIALTIES

## 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. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for downspout boots.
2. Section 06 10 00 "Rough Carpentry" wood nailers, curbs, and blocking.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
4. Section 07 92 00 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

### 1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include copings, roof-edge specialties, roof-edge drainage systems made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

## 1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

## 1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

## 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 07 54 19, "POLY-VINYL CHLORINE (PVC) ROOFING

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

## 1.08 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.09 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings, roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings, roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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 thermal movements. Base calculations 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.

## 2.02 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

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. ATAS International, Inc.
   b. Metal-Era, Inc.
   c. OMG, Inc.
   d. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.

2. Extruded-Aluminum Coping Caps: Extruded aluminum, 0.125 inch thick.

   a. Finish: Two-coat fluoropolymer
   b. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and mechanically clinched and sealed watertight.
4. Special Fabrications: Two-way sloped coping cap.
5. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.

   a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
   b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet, stainless steel.

## 2.03 ROOF-EDGE DRAINAGE 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. ATAS International, Inc.
2. Metal-Era, Inc.
3. OMG, Inc.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.050 inch thick.
2. Gutter Profile: Style K highback according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and mechanically clinched and sealed watertight.
4. Gutter Supports: Manufacturer's standard supports as selected by Architect finish matching the gutters.

5. Gutter Accessories: Continuous hinged leaf guard of solid metal designed to shed leaves.

C. Downspouts: Open-face rectangular complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.050 inch thick.

D. Aluminum Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

## 2.04 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

## 2.05 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

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. ATAS International, Inc.
b. Carlisle WIP Products; a brand of Carlisle Construction Materials.
c. Henry Company.
d. Owens Corning.
e. Polyglass U.S.A., Inc.

f. Protecto Wrap Company.

2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

B. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

## 2.06 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane, silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

F. Solder for Copper: ASTM B32, lead-free solder

## 2.07 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: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

E. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions

F. Aluminum Extrusion Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA [2604] [2605]. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches

between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings, roof-edge specialties, and reglets and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

## 3.03 INSTALLATION, GENERAL

A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

## 3.04 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
   1. Interlock face-leg drip edge into continuous cleat anchored to substrate at required spacing that meets performance requirements.

## 3.05 INSTALLATION OF ROOF-EDGE SPECIALITIES

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

## 3.06 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant make watertight. Slope to downspouts.

   1. Install continuous leaf guards on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Provide elbows at base of downspouts to go into downspout boots / underground drainage system.
2. Connect downspouts to underground drainage system indicated.

## 3.07 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Section 04 20 00 "Unit Masonry" for installation of reglets.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

## 3.08 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 roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

SECTION 07 84 43

JOINT FIRESTOPPING

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior wall/wall intersections.
3. Joints in smoke barriers.

B. Related Requirements:
1. Division 22- PLUMBING: Plumbing System penetrating through fire rated construction.
2. Division 23- HVAC: Heating, ventilating and air conditioning system penetrations through fire rated construction.
3. Division 26 - ELECTRICAL: Electrical system penetrations through fire rated construction.
4. Division 40- PROCESS INTEGRATION: Water treatment process system penetrations through fire rated construction.

### 1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

### 1.04 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.05 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.02 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. Hilti, Inc.
c. Rockwool International.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. Hilti, Inc.
c. Rockwool International.

2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

E. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

D. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.02 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

## 3.03 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Mildew-resistant joint sealants.
6. Latex joint sealants.

B. Related Requirements:
1. Section 04 20 00- UNIT MASONRY.
2. Section 07 62 00- SHEET METAL FLASHING AND TRIM: Sealant integral with flashings.
3. Section 07 84 00- FIRESTOPPING: Firestopping sealants and related backing materials.
4. Section 08 17 43 AF COMPOSITE DOORS AND FRAMES: Interior and exterior fiberglass frames to receive perimeter sealant provided by this section.
5. Section 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES: Interior and Exterior sealants of polycarbonate panel assemblies.
6. Section 08 91 19 – FIXED LOUVERS: Interior and exterior of louver perimeters.
7. Section 09 90 00 - PAINTING: Sealants used in preparation of applied finish coatings.

### 1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.03 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

## 1.04 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction laboratory test reports.

C. Preconstruction field-adhesion-test reports.

D. Field-adhesion-test reports.

E. Sample warranties.

## 1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

## 1.06 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

## 1.07 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealant As selected by Architect from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation.
c. Sika Corporation; Joint Sealants.

C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. The Dow Chemical Company.

D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation.
c. The Dow Chemical Company.

E. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. The Dow Chemical Company.

F. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Soudal USA.
b. The Dow Chemical Company.

G. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. May National Associates, Inc.; a subsidiary of Sika Corporation.
b. Pecora Corporation.
c. Sika Corporation; Joint Sealants.

H. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. May National Associates, Inc.; a subsidiary of Sika Corporation.
b. Pecora Corporation.
c. Sika Corporation; Joint Sealants.

I. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. May National Associates, Inc.; a subsidiary of Sika Corporation.

J. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. May National Associates, Inc.; a subsidiary of Sika Corporation.
b. Sika Corporation; Joint Sealants.

2.03 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. Tremco Incorporated.

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. The Dow Chemical Company.

D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. The Dow Chemical Company.

E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Tremco Incorporated.

2.04 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. Tremco Incorporated.

B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Sika Corporation; Joint Sealants.

C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. LymTal International Inc.

D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 35, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Bostik, Inc.

E. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Pecora Corporation.

c. Permathane®/Acryl-R®; ITW Polymers Sealants North America.

F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Pecora Corporation.

G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Sherwin-Williams Company (The).

H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Tremco Incorporated.

I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Pecora Corporation.
c. Sika Corporation; Joint Sealants.

J. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. LymTal International Inc.

K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement

capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BASF Corporation.
    b. Pecora Corporation.
    c. Sika Corporation; Joint Sealants.

2.05 IMMERSIBLE JOINT SEALANTS

A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 1, tested in deionized water unless otherwise indicated

B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Tremco Incorporated.

C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. BASF Corporation.

D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Tremco Incorporated.

E. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BASF Corporation.
    b. Sika Corporation; Joint Sealants.

F. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Pecora Corporation.
c. Tremco Incorporated.

G. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Tremco Incorporated.

H. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sika Corporation; Joint Sealants.
b. Tremco Incorporated.
c. W.R. Meadows, Inc.

I. Urethane, Immersible, M, NS, 50, T, NT, I: Immersible, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. LymTal International Inc.
b. Tremco Incorporated.

J. Urethane, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Sika Corporation; Joint Sealants.

K. Urethane, Immersible, M, P, 25, T, NT, I: Immersible, multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. LymTal International Inc.
c. Sika Corporation; Joint Sealants.

2.06 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. The Dow Chemical Company.
c. Tremco Incorporated.

C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sherwin-Williams Company (The).
c. Tremco Incorporated.

2.07 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alcot Plastics Ltd.
b. BASF Corporation.
c. Construction Foam Products; a division of Nomaco, Inc.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

## 2.08 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# PART 3 - EXECUTION

## 3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

## 3.02 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

## 3.03 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.04 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces: JS-A.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Joints between plant-precast architectural concrete paving units.
c. Tile control and expansion joints.
d. Joints between different materials listed above.
e. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion: JS-B

1. Joint Locations:
a. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces: JS- C

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Control and expansion joints in unit masonry.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces: JS-D

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces: JS-E.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.
c. Vertical joints on exposed surfaces of unit masonry, concrete walls and partitions.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement: JS-F.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces: JS-G.

1. Joint Locations:

   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

H. Joint-Sealant Application: Concealed mastics: JS-H.

1. Joint Locations:

   a. Aluminum thresholds.
   b. Sill plates.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

END OF SECTION

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. Stainless Steel Doors and Frames.
4. Louvers installed in hollow metal doors.
5. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section “Flush Wood Doors”.
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. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.

1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:

a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.37, R-Value 2.7, including insulated door, thermal-break frame and threshold.

2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:

a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

F. 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.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

## 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 (C).
2. Curries Company (CU).
3. Pioneer Industries (PI).

## 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 (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.

    a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
    b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
    c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.

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 be mechanically interlocked with hairline seam. 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".
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.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-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) - Polystyrene Core - 707 Series.
2. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

## 2.4 SPECIAL FUNCTION HOLLOW METAL DOORS

A. Stainless Steel Doors: Subject to the same compliance standards and requirements as standard hollow metal doors, provide 1-3/4" thick doors fabricated from #304 alloy (#316 alloy high corrosive resistant where indicated) stainless steel material complying with ANSI/ASTM A167. Fabricate doors with stainless flush top closure, and 12 gauge minimum stainless steel hinge reinforcements and 18 gauge minimum stainless steel lock reinforcements.

1. Finish: Provide finish (No.4 with visible grain or No. 8, mirror) as directed.

2. Manufacturers Basis of Design:

    a. CECO Door Products (C) - Stainless-Tech Series.
    b. Curries Company (CU) - Stainless Steel Series.

## 2.5 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.

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.

## 2.6 SPECIAL FUNCTION HOLLOW METAL FRAMES

A. Stainless Steel Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated frames fabricated from #304 alloy (#316 alloy, high corrosive resistant where indicated) stainless steel material in finish matching stainless steel doors.

1. Manufacturers Basis of Design:

a. CECO Door Products (C) - Stainless-Tech Frame Series.
b. Curries Company (CU) - Stainless Steel Frame Series.

## 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 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

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 louvers 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.

## 2.9 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.

## 2.10 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.

## 2.11 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. 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.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Electrical Raceways: Provide hollow metal doors to receive 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 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

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".
12. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

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.

2.12 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 08 14 16

FLUSH WOOD DOORS

## PART 1 – GENERAL

1.01 SUMMARY

A. Furnish the following products to be installed under the designated Sections:

1. Flush solid core wood doors, complete with necessary blocking, hardware cut-outs; and provided with openings for glazing and louvers, where so indicated, for installation under: Section 06 20 00 - FINISH CARPENTRY.
2. Glazing beads, loosely attached to glazing cutouts in doors for removal and permanent installation under: Section 08 80 00 - GLAZING.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers; installation of steel door frames.

B. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds, frames, casing and trim; installation of doors and hardware.

C. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.

D. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cutouts.

E. Section 08 80 00 – GLASS AND GLAZING: Installation of glazing in doors.

F. Section 09 91 00 - PAINTING: Applied opaque and transparent finish coatings.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. ANSI A 208.1 - Wood Particleboard.
3. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
4. ASTM D 523 - Specular Gloss.
5. ASTM D 5456 –Evaluation of Structural Composite Lumber Products..

6. NFPA publication 80 - Fire Doors and Windows.
7. WDMA Industry Standard IS 1-A-11.
8. UBC 43.2 – Fire Tests of Door Assemblies.
9. UL 10B - Fire Tests of Door Assemblies.
10. UL 10C – Positive Pressure Fire Door Test Method.
11. Warnock-Hersey - Certification Listings for fire doors.
12. All applicable federal, state and municipal codes, laws and regulations for exits.

## 1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Fabricator's product data sheets, specifications, and performance data.
2. Certification:
   a. General: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
   b. Provide signed certification by agent of door manufacturer stating that machining, glazing and finishing of doors shall be performed by only by the manufacturer in its facilities.
   c. Urea-formaldehyde resin: Certify that all composite wood, agrifiber products, and adhesives used on this Project do not contain urea-formaldehyde resin.
      1) Written certification from door manufacturer, that all doors incorporated into the Work, and their components are fully "formaldehyde free", including all door cores and other concealed components.
3. Door schedule: All doors specified under this Section, coordinated with the both door and hardware schedules contained in the Contract Drawings.
   a. Indicate doors to be factory finished and finish requirements.
   b. Indicate fire protection ratings for fire rated doors.
4. Shop drawings: Elevations, and large scale sections and details of door construction, indicating profiles, core construction, joinery, edges, and cut-outs for hardware and glazing.
   a. Indicate dimensions and locations of mortises and holes for hardware.
   b. Indicate dimensions and locations of cutouts.
   c. Indicate requirements for veneer matching.
5. Selection samples: Plastic laminate sample chain.
6. Verification samples:

a. Corner section of specified flush type door, showing core construction and joinery.

b. For transparent finishes: submit two 8 by 10 inch mounted finished samples of each specie of veneer specified.

c. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

d. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.05 QUALITY ASSURANCE

A. All materials and workmanship shall conform in all respects to the specified grades of the Window and Door Manufacturer's Association (WDMA) Industry Standard IS 1-A-97, except as modified herein.

1.06 REGULATORY REQUIREMENTS

A. Fire rated door construction shall conform to UL publications 10B and 10C.

B. Install doors in compliance with NFPA publication 80.

C. Corridor door assemblies shall be tested and listed per UL 1784.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.

B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.

C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Engineer. Verify that issued templates are coordinated with the approved schedule; immediately notify the Engineer, in writing, of any conflicts.

1.08 DELIVERY, STORAGE AND HANDLING

A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.

B. Deliver wood doors in resilient non-staining moisture proof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.

C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Engineer; otherwise remove and replace damaged items.

D. Store doors flat on a level surface, in protected, elevated, dry areas; protect from exposure from all sources of light and moisture. When required to maintain manufacturer's warranty, seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.10 WARRANTY

A. Provide the following warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT. Warranties shall include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction, all as defined by AWI Quality Standards.

1. Warranty length:

a. Interior doors: Manufacturer's lifetime warranty.

2. Warranty coverage shall include all labor and material costs of delivery, re-hanging, re-finishing, glass and glazing to produce a complete installation of replaced or repaired doors.

## PART 2 - PRODUCTS

2.01 FLUSH FACED DOORS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Algoma Hardwoods, Inc., Algoma WI.
2. Marshfield DoorSystems™, Inc., Marshfield WI.
3. Eggers Industries, Architectural Door Division, Two Rivers WI.
4. Lambton Doors, Lambton Quebec Canada.
5. Oshkosh Door Company, Oshkosh WI.
6. VT Industries Inc., Holstein IA.

B. General requirements: Conform to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1-A-11, and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cutouts in doors, and other characteristics of doors to be furnished hereunder.

1. Door Grade: Custom.

2. Door Facing:
    a. Face veneer: WDMA Industry Standard, “A’ Grade veneer minimum 1/50 inch (0.6 mm) thick, mechanically splice Select White Maple (Acer saccharum) {sapwood}, Plain Sliced with book matched grain, end matched transoms.
        1) Matching of adjacent pieces of veneer: Book matched.
        2) Panel face assembly: Balanced.
    b. Face veneer: MDO (Medium Density Overlay) face veneer, factory primed ready for field applied paint finish.
    c. Crossbanding: Hardwood veneer or composite product at least 1/16 inch thick.

2.02 NON-RATED SOLID-CORE DOORS

A. General Construction: WDMA Industry Standard I.S. 1-A-11, S-9 Veneer, Particleboard Core Bonded, Premium Grade Door.
    1. WDMA Specification Description: “PC-5”.
    2. Door thickness: 1-3/4 inches, unless indicated otherwise.

B. Door facing: As specified herein above under Article – “Flush Faced Doors”.

C. Core construction:
    1. Core: Particleboard complying with ANSI A208.1 Type 1, Grade 1-LD-2 having a density of 33 pounds per cubic foot.
        a. Provide only formaldehyde free particleboard, equal to Rodman Industries, Oconomowoc, WI. Furnish certification of formaldehyde free products.
    2. Stiles: Laminated strand lumber or hardwood mill option for inner ply of styles, continuously bonded to core with adhesives and abrasively planed before veneering, minimum of 1-3/8 inches after trimming, with 1/4 inch solid hardwood outer ply matching face veneer, or visually compatible hardwood species.
    3. Top and bottom rails: Maple, Birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements, minimum 1-1/8 inch width.

D. Adhesives: Type 1 (waterproof) for both face and core assembly.

2.03 GLAZING BEADS

A. Glazing beads for non-fire rated doors:
    1. Algoma’s style number W-4 wood bead with 3/8 inch sight line.
    2. Eggers style number 100, 5/8 inch sight line.
    3. Marshfield DoorSystems style number W-6, 3/8 inch sight line.

4. VT Industries Type “VT-1”

## 2.04 FABRICATION

A. Fabricate doors in accordance with specified manufacturer’s requirements. Fabricated rated doors in compliance with WHI, or UL requirements as appropriate.

B. Laminate door facing, cross banding and assembled core in a hot press.

C. Bond stiles and rails to cores, sand for uniform thickness. Factory sand assembled door leaf.

D. Factory-machine doors to receive hardware from templates furnished under Section 08 71 00 - DOOR HARDWARE. Do not machine for surface hardware.

1. Provide inner blocks at lock edge and top of door for closer hardware reinforcement.
2. Cut and configure door edges to receive scheduled gasketing.

E. Factory fabricate doors for undercut where scheduled.

F. Factory cut lite openings as scheduled.

G. Factory cut all louver and glazed openings as scheduled. Field cutting of openings is prohibited.

H. Fabrication tolerances: Maximum diagonal distortion (warp): 1/4 inch (6 mm) measured with straight edge from corner to corner over a maximum 42 by 84 inch surface area.

## 2.05 FACTORY FINISHING

A. General: Factory finish to be to comply with EPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations.

B. Transparent finish: AWI Premium Grade Factory Finish System 9, having water based stain and ultraviolet (UV) cured polyurethane sealer and topcoat, with a satin sheen of 31° to 35° gloss units per ASTM D523.

1. Finish system shall include the following:
   a. Finish sanding.
   b. Stain application.
   c. Stain curing.
   d. Sealer application - first coat.
   e. Sealer gel cure.
   f. Sealer application - second coat.
   g. Sealer gel cure

h. Sealer application - third coat

i. Sealer full cure

j. Sealer sanding

k. Topcoat application - first coat

l. Topcoat application - second coat

m. Topcoat full cure

C. Opaque finish: Factory prime MDO veneer doors with acrylic primer ready for field applied finish coatings, under Section 09 91 00 – PAINTING

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of wood doors, including all accessories and related items furnished hereunder, will be performed under Section 06 20 00 - FINISH CARPENTRY.

B. Final installation of loosely attached glazing stops will be performed under Section 08 80 00 – GLASS AND GLAZING.

END OF SECTION

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SECTION 08 31 13

ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

B. Related Requirements:
1. Section 04 20 00, UNIT MASONRY: Installation of access panels into masonry assemblies.
2. Section 09 29 00, GYPSUM BOARD: Installation of access panels in gypsum wall board assemblies.
3. Division 22- PLUMBING
4. Division 23- HVAC
5. Division 26- ELECTRICAL

### 1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames.

### 1.03 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

### 1.04 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[ and temperature-rise limit] ratings indicated, according to NFPA 252 or UL 10B.

## 2.02 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Babcock-Davis.
   b. JL Industries, Inc.; a division of the Activar Construction Products Group.
   c. Larsens Manufacturing Company.

2. Description: Face of door flush with frame; with concealed flange for installation and concealed hinge.
3. Locations: Wall and ceiling
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory finished.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory finished.
6. Stainless Steel Sheet for Door: Nominal 0.062 inch , 16 gage, ASTM A480/A480M No. 4 finish.
7. Frame Material: Same material and thickness as door
8. Latch and Lock: Cam latch, screwdriver operated

B. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Babcock-Davis.
   b. JL Industries, Inc.; a division of the Activar Construction Products Group.
   c. Maxam Metal Products Limited.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling
4. Fire-Resistance Rating: Not less than that of adjacent construction indicated on drawings.
5. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory finished.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory finished.
8. Stainless Steel Sheet for Door: Nominal 0.038 inch, 20 gage, ASTM A480/A480M No. 4 finish.
9. Frame Material: Same material, thickness, and finish as door
10. Latch and Lock: Self-closing, self-latching door hardware, Cam latch, screwdriver operated.

2.03 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304]. Remove tool and die marks and stretch lines, or blend into finish.

E. Stainless Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

F. Frame Anchors: Same material as door face.

G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.04 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Retain "Mortise Cylinder Preparation" Subparagraph below if lock is not provided by access door and frame manufacturer.

2.05 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.02 FIELD QUALITY CONTROL

A. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

END OF SECTION

SECTION 08 36 13

SECTIONAL DOORS

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install:

1. Electrically operated sectional door assembly, complete with tracks, clip angles, guides, operating hardware and mechanisms, wireless door controllers, operating control stations, weather seals, and all related items.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - UNIT MASONRY: Concrete block wall and veneer.

B. Section 05 40 00 – COLD-FORMED METAL FRAMING.

C. Section 05 50 00 - METAL FABRICATIONS: Providing hot dip galvanized steel angles, plates and supports for door springs, tracks, and operators.

D. Section 06 20 00 - FINISH CARPENTRY: Installation of cylinder locks in sectional door[s].

E. Section 07 92 00 - JOINT SEALANTS: Perimeter sealant and backup materials.

F. Section 08 71 00 - DOOR HARDWARE: Furnishing cylinders for sectional door[s].

G. Section 13 42 00 – PRE-ENGINEERED METAL BUILDINGS.

H. Division 26 - ELECTRICAL:

1. Conduit from electric circuit to door operator and from door operator to control station.
2. Electrical power wiring and conduit from the building power supply to the motors, and from the motors to the operating control stations.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ANSI A 216.1 - Sectional Overhead Type Door (NAGDM 102).
2. ANSI/AHA A 135.4 - Basic Hardboard.

3. ASTM A 446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical) Quality.
4. ASTM A 526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Commercial Quality.
5. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
6. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
7. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
8. NEMA 250 - Enclosures for Electrical Equipment.
9. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
10. NEMA MG1 - Motors and Generators.
11. NFPA 70 - National Electrical Code.

## 1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, and performance data.
2. Manufacturer's installation instructions. Indicate installation sequence and procedures, adjustment and alignment procedures and lubrication instructions.
3. Maintenance Data: Lubrication requirements and frequency, periodic adjustments required.
4. Warranty: Provide sample 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.
5. Shop drawings: Fully-dimensioned, large scale details of door construction, tracks, guides, counterbalancing and operating mechanisms, electrical characteristics, and related items; with complete installation details reflecting actual site conditions for each location.
   a. Indicate electrical requirements, connection details.
6. Selection samples:
   a. Sample card indicating Manufacturer's full range of finishes available for selection by Engineer.

## 1.05 QUALIFICATIONS

A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.06 WARRANTY

A. Provide 5 year warranty under provisions of Section 01 78 00 – PROJECTCLOSEOUT. Warranty shall include materials and workmanship of overhead doors and electric motor, satisfactory operation, and contain any limitations of items specified herein. Provide manufacturer's limited door and operators system warranty for 10 years against delamination of polyurethane foam from steel face and all other components for 5 years or 20,000 cycles, whichever comes first from the date of substantial completion.

1.07 MAINTENANCE

A. Provide Installers maintenance contract under provisions of Section 01 78 00 – PROJECT CLOSEOUT, for a period of one year form Date of Project Substantial Completion. Maintenance contract includes:

1. Emergency callback service for the doors and grilles.
2. Two post-installation examinations of doors during regular working hours by trained employees of the door manufacturer. (one six months into warranty period, and one in last 30 days of warranty period).
   a. Perform all necessary adjusting, greasing, and oiling.
3. Cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect caused by others.

B. Repair work shall be carried out only by the installer's personnel, using only standard parts furnished by the door manufacturer. Maintenance shall be carried out directly by the installer and shall not be assigned or transferred to any agent.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Overhead Door Corp., Dallas TX, Series 596 Extra Heavy Duty Thermacore Door System".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Overhead Door Corp., Dallas, TX.
2. Raynor Garage Doors, Dixon, IL.
3. Clopay Building Products, Mason, OH.

2.02 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with *International Building Code*, 2006 edition, as published by the International Code Council, Inc. (I.C.C.), as amended and incorporated under Title 19 NYCCR part 1221

- *Building Code of New York State* (BCNYS), 2010 edition as measured in accordance with ASTM E 330.

B. Maximum air leakage per foot of door perimeter (sill, jamb and header) shall not exceed 0.08 CFM (6.36 cm2/min) at 25 MPH (402 KM/hr). No air leakage shall be detected between section joints when tested in accordance with ASTM E-283.

## 2.03 COMPONENTS

A. Panels: Steel construction, flush textured outer steel sheet of 20 gage thick, hot dip galvanized, inner steel sheet of 20 gage thick, hot dip galvanized, core reinforcement of 26 gage thick sheet steel roll formed to channel shape, weathertight shiplap joints at meeting rails.

1. End stiles: 16 gauge with thermal break.
2. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated. Minimum R-value: 17.4.

B. Door Nominal Thickness: 2 inches thick.

C. Glazing: Manufacturer's standard insulated double strength glass.

1. Glazed lites: Full panel width, set in place with resilient glazing channel.

D. Track: 12 gage thick, 3 inch wide rolled galvanized steel track, continuous on piece per side; galvanized steel mounting brackets, 1/4 inch thick.

E. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

F. Lift Mechanism: Heavy duty torsion spring on cross head shaft, with braided steel lift cables.

1. Springs: Oil tempered, heavy-duty torsion springs, helical wound rated for 100,000 cycles.

G. Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

## 2.04 ELECTRICAL COMPONENTS

A. Motor: Horsepower as recommended by the manufacturer based on door size and weight but in no case less than ½ HP, three phase 60 hz, industrial heavy duty, NEMA MG1, Type 4, totally enclosed, instant reversing, with electric interlock to prevent operation when lock bolts are engaged in guides and 20,000 cycle warranty with counter.

1. Manually operable in case of power failure, transit time of 12 inches per second.
2. Reversing contact: Heavy-duty, electrically and mechanically interlocked.
3. Limit switches: Adjustable rotary type, synchronized with door.

4. Control circuit: 24 VAC, Class 2.
5. Reduction: Worm gear running in oil bath, primary; chain and sprocket, secondary.
6. Clutch: Adjustable friction type.
7. Brake: Solenoid actuated drum type.
8. Mounting: Wall mounted.
9. Control stations: 3-button.
10. Wireless door controllers

B. Provide photoelectric sensors complying with UL 325 wired into door control systems.

C. Wiring termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicate. Enclose terminal lugs in terminal box sized to NFPA 70.

D. Disconnect switch: Factory mount disconnect switch in control panel.

E. Electric operator: Side mounted on cross head shaft, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.

F. Control station: Standard three button (open-close-stop) momentary type, control for each electric operator; 24 volt circuit, surface mounted for each individual overhead door.

G. Provide series of 3-button controllers to operate all overhead doors in remote location as indicated on the Drawings.

H. Safety edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to reverse door upon striking object; hollow neoprene covered to provide weatherstrip seal. Do not cut weatherstrip seal for wiring of safety edge

I. The electrical contractor shall provide disconnect switches, starters and all line voltage wiring and conduit to overhead (OH) door operators. The hand-off-auto switch, push button control station (momentary up-stop-down) and controller is furnished by the OH door manufacturer and installed by the OH door contractor. The electrical contractor is to provide conduit and wiring between the hand-off-auto switch, the push button control station, and controller per OH door manufacturer requirements. Furnishing and installation of the motor unit, optical sensors, door safety bottom, low voltage wiring and all other accessories associated with the overhead doors shall be the responsibility of the OH door contractor. The electrical contractor is responsible to provide and install starters, disconnect switches, and combination starter/disconnect devices.

J. Motion sensor: Uni-directional microwave motion sensor with an IP65 degree of protection, 24.150 GHz radiated frequency, 100 millisecond reaction time and 9-patch antenna equal to BEA Industrial "Falcon" sensor.

K. Green and red stop and go indicator LED lights for overhead doors in Vehicle Storage, including exterior applications as needed. Indicator lights to be 24v and shall be compatible with control wiring for overhead door controls. Use of 120v light will require electrical connection at no additional cost. Lights shall indicate red while door is in motion and green only when door has reached open limit. Light shall be off when door is in closed position. Lights shall be located as indicated on the Drawings or as determined in the field based on Owner's preference.

2.05 FINISHES

A. Exterior and interior steel surfaces: Two coat baked-on polyester enamel.

1. Exterior color: As selected by Engineer from manufacturer's available colors at Vehicle Storage and Maintenance.
2. Exterior Color at Shops: Custom color to match Engineer's sample.
3. Interior color: Manufacturer's standard white.

2.06 FABRICATION

A. Do not fabricate doors until all specified submittals have been submitted to, and approved by, the Engineer.

2.07 ACCESSORIES

A. Provide photoelectric sensors complying with UL 325 wired into door control systems.

B. Remote control door devices provided by the door manufacturer as follows:

1. Vehicle Storage and Maintenance doors: Forty (40) 4 button controllers.
2. Shop doors: Twenty (20) 3 button controllers.

C. Duplicate momentary push button control stations, as provided by the door manufacturer for the following doors: .

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect and verify wall openings are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.

3.02 PREPARATION

A. Prepare opening[s] to permit correct installation of door unit to perimeter air and

vapor barrier seal.

B. Verify that electric power is available and of the correct characteristics.

3.03 INSTALLATION

A. Perform installation of door units, except as otherwise specified, in accordance with the approved shop drawings and the recommendations of the manufacturer.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Brace door tracks suspended from structure. Secure tracks to structural members only.

D. Set entire assembly including doors, guides, and hardware, plumb and true to line, to assure smooth operation.

E. Coordinate installation of electrical service for sectional overhead door with Division 16 - ELECTRICAL. Complete power and control wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter of sectional overhead door as specified in Section 07 92 00 - JOINT SEALANTS.

3.04 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work. Maximum variation from plumb or level: 1/16 inch. Maximum variation in longitudinal or diagonal warp: 1/8 inch per 10 foot straight edge.

3.05 ADJUSTING

A. Adjust doors, hardware and operating assembly as required to ensure a smooth operation without binding.

3.06 CLEANING

A. Remove all labels, protective films and coverings from assembly components.

B. Clean doors, frames and glass.

C. Remove tools, equipment and all rubbish and debris from the work area, caused by the work of this Section; leave area in broom-clean condition.

3.07 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08 36 23

POLYCARBONATE SECTIONAL DOORS

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install electrically operated polycarbonate sectional high lift door assembly at wash bays, complete with tracks, clip angles, guides, operating hardware and mechanisms, operating control station, weather seals, and all related items.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 – UNIT MASONRY: Concrete block wall and veneer.

B. Section 05 40 00 – COLD-FORMED METAL FRAMING.

C. Section 05 50 00 – METAL FABRICATIONS: Furnishing hot dip galvanized steel angles, plates and supports for door springs, tracks, and operators.

D. Section 06 20 00 - FINISH CARPENTRY: Installation of cylinder locks in sectional door[s].

E. Section 07 92 00 - JOINT SEALANTS: Perimeter sealant and backup materials.

F. Section 08 71 00 - DOOR HARDWARE: Furnishing cylinders for sectional door[s].

G. Section 13 42 00 – PRE-ENGINEERED METAL BUILDING.

H. Division 26 - ELECTRICAL:

1. Conduit from electric circuit to door operator and from door operator to control station.
2. Electrical power wiring and conduit from the building power supply to the motors, and from the motors to the operating control stations.

1.01 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, and performance data.
2. Manufacturer's installation instructions. Indicate installation sequence and procedures, adjustment and alignment procedures and lubrication instructions.
3. Maintenance Data: Lubrication requirements and frequency, periodic adjustments required.
4. Warranty: Provide sample 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.

5. Shop drawings: Fully-dimensioned, large scale details of door construction, tracks, guides, counterbalancing and operating mechanisms, electrical characteristics, and related items; with complete installation details reflecting actual site conditions for each location.
    a. Indicate electrical requirements, connection details.
6. Selection samples:
    a. Sample card indicating Manufacturer's full range of finishes available for selection by Engineer.

1.02 QUALIFICATIONS

A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.03 WARRANTY

A. Provide 5 year warranty. Warranty shall include materials and workmanship of overhead doors and electric motor, satisfactory operation, and contain any limitations of items specified herein.

## PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on American Garage Door Supply, Inc., Bemidji, MN, Model "Survivor Gold".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. American Garage Door Supply, Inc., Bemidji, MN.
2. Airlift Doors, Inc., Minneapolis, MN.
3. Ultimate Products, Inc., Raleigh, NC.

2.02 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with *International Building Code*, 2006 edition, as published by the International Code Council, Inc. (I.C.C.), as amended and incorporated under Title 19 NYCCR part 1221 - *Building Code of New York State* (BCNYS), 2010 edition as measured in accordance with ASTM E 330.

B. Maximum air leakage per foot of door perimeter (sill, jamb and header) shall not exceed 0.08 CFM (6.36 $cm^2$/min) at 25 MPH (402 KM/hr). No air leakage shall be detected between section joints when tested in accordance with ASTM E-283.

## 2.03 MATERIALS

A. Panels: 16mm triple walled polycarbonate with UV absorber set in place with resilient glazing channel.

B. Stiles and Rails: Side rails shall be 0.080 inch aluminum alloy, top and bottom rails shall be 0.080, reinforced to 0.25 inches thick at all stress points, and sloped to eliminate water accumulation.

   1. Bottom Rail: Reinforced full-width rail and retaining U-shaped vinyl or rubber astragal.

C. Track: Hot-dipped galvanized 3 inch steel securely fastened to jambs by continuous angles inclined to ensure weather-tight closure. Hinges and roller brackets shall be minimum 12 gauge hot-dipped galvanized steel, formed to provide mounting for rollers at edges of doors and engineered to provide tight contact between sections. All other supplemental steel, bracing, and framing shall be hot-dipped galvanized.

D. Track: 12 gage thick, 3 inch wide rolled galvanized steel track, continuous on piece per side; galvanized steel mounting brackets, 1/4 inch thick.

   1. Configure track for full vertical lift where clearances allow. At all other locations configure track with maximum vertical lift to limit horizontal intrusion into adjacent space. Final configurations shall be coordinated with clearances available in each space. Show track geometry on shop drawings for review and approval by Engineer.

E. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of stainless steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

   1. Roller assemblies: Sealed bearing, stainless steel shaft with a UHMW tire

F. Lift Mechanism: Torsion spring on stainless steel cross head shaft, with braided steel lift cables.

   1. Springs: Oil tempered, heavy duty hot-dip galvanized steel torsion springs, helical wound rated for 100,000 cycles with nickel plated winding hubs.

G. Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

H. Motor: Horsepower as recommended by manufacturer's requirements based on size and weight of door, but in no case less than ½ HP, 115/230 VAC three phase, 60 hz, NEMA MG1, Type 4, totally enclosed, instant reversing, heavy-duty industrial with electric interlock to prevent operation when lock bolts are engaged in guides.

   1. Manually operable in case of power failure, transit time of 12 inches per second.
   2. Reversing contact: Heavy-duty, electrically and mechanically interlocked.
   3. Limit switches: Adjustable rotary type, synchronized with door.

4. Control circuit: 24 VAC, Class 2.
5. Reduction: Worm gear running in oil bath, primary; chain and sprocket, secondary.
6. Clutch: Adjustable friction type.
7. Brake: Solenoid actuated drum type.
8. Mounting: Wall mounted.
9. Control stations: 3-button keyed.

I. Wiring termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicate. Enclose terminal lugs in terminal box sized to NFPA 70.

J. Disconnect switch: Factory mount disconnect switch in control panel.

K. Electric operator: Industrial heavy duty side mounted on cross head shaft, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.

L. The electrical Trade Contract Bidder shall provide disconnect switches, starters and all line voltage wiring and conduit to overhead (OH) and coiling door operators. The hand-off-auto switch, push button control station (momentary up-stop-down) and controller is furnished by the OH door manufacturer and installed by the OH door contractor. The electrical Trade Contract Bidder is to provide conduit and wiring between the hand-off-auto switch, the push button control station, and controller per OH door manufacturer requirements. Furnishing and installation of the motor unit, optical sensors, pneumatic door safety bottom, low voltage wiring and all other accessories associated with the overhead doors shall be the responsibility of the OH door contractor. The Electrical Trade Contract Bidder is responsible to provide and install starters, disconnect switches, and combination starter/disconnect devices

M. Control station: Exterior-rated three button (open-close-stop) momentary type, control for each electric operator; 24 volt circuit, surface mounted. Provide additional exterior-rated 3-button control stations to operate series of doors in locations as indicated on the Drawings.

N. Safety edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to reverse door upon striking object; hollow neoprene covered to provide weatherstrip seal. Do not cut weatherstrip seal for wiring of safety edge.

O. Provide photo electric sensors complying with UL 325 wired into door control systems.

P. Provide dual photoelectric sensors complying with UL 325 wired into door control systems. Provide two photoelectric sensors at each door at two heights indicate locations on shop drawings.

Q. Color: anodized aluminum frames, color as selected by Engineer from manufacturer's standard color range.

R. Color: Baked-on polyester powder coat, color as selected by Engineer from manufacturer's standard color range minimum 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.

2.04 ACCESSORIES

A. Green and red stop and go indicator LED lights for overhead doors in Vehicle Storage, including exterior applications as needed. Indicator lights to be 24v and shall be compatible with control wiring for Overhead Door controls. Use of 120v light will require electrical connection at no additional cost. Lights shall indicate red while door is in motion and green only when door has reached open limit. Light shall be off when door is in closed position. Lights shall be located as indicated on the Drawings or as determined in the field based on Owner's preference.

B. Provide loop detectors to trigger door on exit.

C. Remote control door devices provided by the door manufacturer as follows:

1. Wash Bay: Twenty (20) 2-button controllers, plus six (6) 1-button.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. Perform installation of door units, except as otherwise specified, in accordance with the approved shop drawings and the recommendations of the manufacturer.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Brace door tracks suspended from structure. Secure tracks to structural members only.

D. Set entire assembly including doors, guides, and hardware, plumb and true to line, to assure smooth operation.

E. Coordinate installation of electrical service for sectional overhead door with Division 26 - ELECTRICAL. Complete power and control wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter of sectional overhead door as specified in Section 07 92 00 - JOINT SEALANTS.

END OF SECTION

SECTION 08 43 13

ALUMINUM-FRAMED STOREFRONT

## PART 1 - GENERAL

### 1.01 SUMMARY

A. The work of this Section consists of aluminum entrances and storefronts where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.

B. Furnish and install the following:

1. Prefinished aluminum exterior entrance and interior storefront framing systems, of the types specified herein, all required integral reinforcing, bracing members and related accessories for the framing systems, and all angles, clips, and other items required to anchor the systems to the building structure.
2. Prefinished aluminum exterior entrance and interior storefront doors.
3. Prefinished aluminum formed brake-metal work, mullion covers, closures, flashings, and similar components, in conjunction with aluminum entrance and storefront framing.
4. Metal to metal sealing of aluminum assemblies.
5. All glass, including insulated panels, and glazing materials for the aluminum framing system.
6. Shimming and fasteners required for installation.

C. Install the following furnished under the designated Sections:

1. Hardware furnished under Section 08 71 00 - DOOR HARDWARE

### 1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - UNIT MASONRY: Preparation of adjacent masonry work to receive work of this Section.

B. Section 05 40 00 - COLD-FORMED METAL FRAMING: Structural stud framing at exterior walls.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood blockings, nailers.

D. Section 07 21 00 - THERMAL INSULATION: Perimeter vapor and air seal between storefront frame and adjacent construction.

E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and back-up materials.

F. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware for the work of this Section.

## 1.03 REFERENCES

A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. AAMA 501 - Methods of Test for Metal Curtain Walls.
2. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
4. AAMA 1503.1 – Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
5. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
6. ANSI A 117.1 - Safety Standards for the Handicapped.
7. ANSI Z 97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
8. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
9. ASTM B 209 - Aluminum Alloy, Sheet and Plate.
10. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
11. ASTM C 509 –Elastomeric Cellular Preformed Gaskets and Sealing Materials.
12. ASTM C 920 - Elastomeric Joint Sealants.
13. ASTM D 523 – Standard Test Method for Specular Gloss.
14. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and storefront, Curtains Walls and Doors.
15. ASTM E 330 Structural Performance of Exterior Entrance and storefront, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
16. ASTM E 331 - Test method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
2. All applicable federal, state and municipal codes, laws and regulations for exits.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of

installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

2. Arrange keying, and schedule delivery of keys, with Owner.

B. Sequencing:

1. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, fabrication methods, finishes, performance data, and installation instructions for each item furnished hereunder.

a. Provide additional information for glazing and sealant products; including chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.

b. Provide hardware schedule and product data sheets for each type of hardware.

2. Shop Drawings, bearing registration stamp of a Professional Structural Engineer registered in the State of New York.

a. 1/4 inch scale elevations and plans of each entrance and storefront system condition, indicate all hardware mounting heights.

1) Indicate all types and thickness of glass.

b. Large scale design details; indicating sizes, types, and gauges of all metal components; expansion provisions, and glazing details.

1) Provide details of perimeter conditions and typical joinery. Indicate which framing members run through and how joints are sealed.

2) Provide details of transition areas and modifications to standard system components.

3) Provide details of bracing and stabilizing members; attachment clips and brackets; and complete installation details.

4) Indicate building column line reference dimensions.

c. Provide reaction loads imposed on the structure, including all deadload, seismic, and windload reactions at each anchor location.

d. Design engineering shall be the responsibility of the framing systems manufacturer, and may vary from those indicated on the Contract Drawings, but basic sight lines shall be retained.

3. Selection Samples:
    a. Sample card indicating Manufacturer's full range of coating colors available for selection by Engineer.
    b. Provide physical samples as requested by Engineer for initial selection of colors and finishes.
    c. Manufacturer's sample boards for sealant colors, for selections by the Engineer.
4. Verification Samples:
    a. After receipt of selected standard colors from the Engineer, submit at least two 12-inch long pieces of major metal extruded components of the systems, and 12 by 12 inch samples of finished aluminum sheet used for brake metal components, prefinished in the specified finish system in selected colors.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT.
1. Bonds and Warranty Documentation:
    a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

## 1.06 QUALITY ASSURANCE

A. General: Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Sole Source: Except for glass, obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of storefront framing.

C. Professional Engineer Qualifications: Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of New York.

## 1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Deliver hardware scheduled for field installation packaged individually. Label and identify each package with door opening code to match hardware schedule.
    a. Obtain receipts for when hardware is received by other trades.

B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures.

2. Protect materials from damage due to moisture, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
    a. Protect finished metal surfaces from damage during fabrication work, shipping, storage, and erection. Protect pre-finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.08 SITE CONDITIONS

A. Do not install sealant when ambient temperature is less than 40 degrees Fahrenheit.
    1. Maintain this minimum temperature during and 48 hours after installation of sealant.

1.09 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

B. Manufacturer Warranty:
    1. Manufacturer's written warranty for entrance and storefront systems, covering repair or replacement of any system which leaks, or exhibits defects in materials, finish, design, within 2 years from date of substantial completion of the General Contract. Failure due to defective materials or workmanship is deemed to include, but not to be limited to:
        a. Failures in operation of operating component or components.
        b. Leakage or air infiltration in excess of the specified standard.
        c. Deterioration of finish to an extent visible to the unaided eye.
        d. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the work of this Section or the Work as a whole.
    2. Finish System Warranty: polyvinylidene fluoride enamel finish 10 year coating warranty assigned specifically to project, covering film integrity (including chipping, crazing, pitting, and delamination), chalk resistance and color fading, color change.

C. Insulating Glass: Manufacturer's 10 year written guarantee covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.
    1. Provide coverage in Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.

## PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kawneer North America (A Division of Alcoa), Norcross GA, Product: "451 UT".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Kawneer North America (A Division of Alcoa), Norcross GA.
2. EFCO (A Division of Pella), Monett MO.
3. YKK AP America Inc., Austell GA.

2.02 DESCRIPTION

A. Storefront framing systems: Integrated flush-glazed, outside glazed, thermally broken, stick fabricated system. Vertical and horizontal framing members shall be of shear block construction.

1. System shall provide flush glazing on all sides for the indicated thickness of glass, with no projected glazing stops.
2. Provide extra thick gauge aluminum or supplemental internal support framing steel as required to meet spans indicated on the Drawings and wind loading requirements at no additional cost to Owner.

2.03 PERFORMANCE/DESIGN CRITERIA

A. General: Design, fabricate, assemble and erect storefront system, and interfacing conditions with contiguous work, to ensure continuity of building enclosure vapor and air barriers and that all segments of the assemblies will be free from leakage under every condition of weather and exposure. In addition to the specified performance requirements, storefront system shall conform to, or exceed the requirements of the applicable building code and referenced industry standards for air infiltration, water infiltration, operating forces, deflection and deformation under load.

B. Engineering criteria: The manufacturer for storefront system shall employ the services of a qualified structural engineer, registered to practice in the State of New York, to prepare all calculations and other performance criteria for the respective systems, and bear all costs therefor. All shop drawings for the metal components of the respective systems shall bear the registration stamp of the engineer.

1. Wind loading: Conform to *International Building Code*, 2006 edition, as published by the International Code Council, Inc. (I.C.C.), as amended and incorporated under Title 19 NYCCR part 1221 - *Building Code of New York State* (BCNYS), 2010 edition amendments:

a. Basic Wind Speed: 100 miles per hour. (three-second-gust).

C. Testing Requirements: Provide manufacturer's testing and submit test data. Demonstrate compliance with specified requirements.

1. Test Sequence: Air infiltration testing shall precede water resistance testing.

D. Test samples:

1. Frame Sample(s) for air infiltration, water penetration and structural tests: Minimum sample size: 12-0" high by 4'-0" wide.
2. Door Samples for air infiltration tests:
   a. For single doors: Minimum size 3'-0" x 7'-0.
   b. For double doors: Minimum size 6'-0" x 7'-0".

E. Frame:

1. Air infiltration through assembly: tested specimen in accordance with ASTM E 283, with a static pressure difference of 6.24 psf, shall not exceed 0.06 cfm per square foot of unit surface area.
2. Water resistance: test specimen in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf as defined in AAMA 501.
3. Deflection: test in accordance with ASTM E330 at a static air pressure difference of 31 psf (positive and negative).
   a. Deflection of framing members perpendicular to the plane of the wall shall not exceed L/175 of its clear span.
   b. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2 percent of their clear spans shall occur.
4. Uniform structural loading: test in accordance with ASTM E330 at a static air pressure difference of 1.5 times the design wind pressure prescribed by the *International Building Code*, 2006 edition, as published by the International Code Council, Inc. (I.C.C.), as amended and incorporated under Title 19 NYCCR part 1221 - *Building Code of New York State* (BCNYS), 2010 edition. Test will result of no water leakage glass breakage, permanent damage to fasteners, permanent deflection in framing, or other damage which would cause the storefront be defective.
5. Condensation resistance tests (CRF): conform to AAMA 1503.1 for a minimum CRF of 56, and a maximum overall system conductive thermal transmittance "U-Value" of Uc 0.36.

F. Entrance doors:

1. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 1.57 psf.

a. For single doors, air infiltration shall not exceed 0.50 cfm per linear foot of perimeter crack.

b. For double doors, air infiltration shall not exceed 0.10 cfm per linear foot of perimeter crack.

2.04 FRAMING SYSTEM

A. Exterior and interior storefront framing systems: Nominal dimension of 2 inch face width by 4-1/2 inch total depth, thermally broken system for insulating glass.

1. Kawneer "Trifab VersaGlaze 451UT" system.
2. EFCO "403X" system.
3. YKK AP America: "YES 45 XT" system.
4. Wausau: "TU 24000".

2.05 MATERIALS

A. Framing and door members shall be of extruded aluminum 6063-T5, 6063-T6, or 6061-T6 alloy and temper, as recommended by manufacturer for strength, corrosion resistance and specified finish, complying with ASTM B 221.

B. Sill track shall be of special purposed high strength extruded aluminum in either 6351-T5 or 6061-T5 alloy and temper as recommended by manufacturer for strength, corrosion resistance and specified finish, complying with ASTM B 221.

C. Formed flashings and closures shall be of aluminum Alloy/temper 5005-H34, minimum of 0.083 inch thick, complying with ASTM B 209.

1. Provide and install all miscellaneous formed aluminum work in conjunction with the aluminum frame work as detailed and as required to complete the work including but not limited to sills, mullion covers, closures, flashings.

D. Aluminum sections shall be of sizes and profiles indicated on the approved shop drawing details; shall present straight, sharply defined lines and arises; and shall be free from defects impairing strength, durability, or appearance.

E. Provide extra thick gauge aluminum or supplemental internal support framing steel as required to meet spans indicated on the Drawings and wind loading requirements at no additional cost to Owner.

2.06 ENTRANCE DOORS

A. Aluminum doors shall be thermally broken extruded aluminum, preglazed, single acting, hinged doors, medium stile-and-rail type. Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, the following:

1. EFCO model "D502 (TS) ThermaStile" door.
2. Kawneer model: "560 Insulclad" door.

3. Wausau “Thermal Block, Wide Stile” door.
4. YKK: “50XT Megatherm Door.

B. Entrance doors:
1. Wall thickness of stile and rail extrusions: not less than 0.125 inch.
2. Wall thickness of glazing stops: not less than 0.050 inch.
3. Thickness of door: 1-3/4 inches.
4. Width of door stiles: 5 inches minimum.
5. Width of top rail: 5 inches minimum.
6. Width of bottom rail: 10 inches minimum (in conformance with 2012 ADA).
7. Fabricate doors with hairline joints at corners of stiles and rails; provide heavy concealed reinforcement brackets secured with screws and welded.
8. Weatherstripping: Wool pile type.

## 2.07 PROJECT–OUT WINDOWS

A. Project-Out windows (vents) in storefront system.
1. Thermally broken, structural silicone glazed, 3 inch nominal deep frame, project-out window.
a. Kawneer “GLASSvent UT” system.
b. EFCO “WV410” system.
c. YKK AP America: “YOW 225” system.
2. Materials
a. Extruded aluminum profiles shall be 6063-T5 alloy and temper (ASTM B221 G.S. 10A-T5).
b. The frame adaptor depth shall be not less than 21⁄4 inches: The ventilator depth shall not be less than 2 inches.
c. All framing members shall have minimum wall thickness of 0.125 inch and shall provide the structural strength sufficient to meet the specified performance requirements.
d. All ventilators shall be tubular.
e. Weatherstripping shall be resilient elastomer.
f. All references to dimensions for wall thicknesses and other cross-sectional dimensions of window members are nominal and in compliance with ANSI H35.2-1990.
3. Hardware:
a. Stainless Steel 4-Bar Hinges.
b. Cast White Bronze Cam Locking Handles.

4. Accessories: Provide insect screens for all operable windows in storefront system.

## 2.08 DOOR HARDWARE

A. Hardware shall be furnished under Section 08 71 00 - DOOR HARDWARE, and installed by aluminum entrance and storefront framing system manufacturer, conforming to governing laws and building codes.

1. Install all reinforcing required and prepare doors for finished hardware specified herein below.

## 2.09 ALUMINUM BRAKE-METAL AND PANNING WORK

A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the aluminum storefront work as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, jamb and sill trim, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with the Work of this Section.

1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable.
2. Provide sheet metal panning not less than 0.060 inch thick.
3. Fasten trim clips, at not more than 16 inches on center.

B. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent “oil canning” or deformation of the finished work. Material deemed defective by the Engineer will be replaced at no cost to the Owner.

C. All brake metal flashing and panning shall be factory finished to match storefront framing.

## 2.10 GLASS AND GLAZING MATERIALS

A. General requirements for glass: Of domestic and foreign 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.

1. 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.

B. Insulated Glass Units: Conform to Class CBA of Insulating Glass Certification Council (IGCC), with a hermetically sealed dehydrated sealed air space, and tested in accordance with ASTM E 2190.

1. Insulating glass shall not experience fogging, wetting or staining within the sealed space, spacer corrosion, spacer migration, adhesive or cohesive failure of primary or secondary edge seal.
2. Insulating glass shall not experience decrease in the air space dimension due to chemical reaction of desiccant with entrapped air. Size of insulating glass spacer shall be calculated according to the pressure differential of the inboard and outboard glass sheets in opposite directions of each unit to prevent contact between the glass sheets in the center of the large insulated glazing units.
3. The insulating glass dimensional tolerances shall conform to the following:
   a. Edge length: +0.12” (3mm), -0.08” (-2mm).
   b. Thickness (with tempered glass): +0.08” (2mm), -0.06” (-1mm).
   c. Thickness (with laminated glass): ±0.06” (.15mm).
4. Insulating glass spacers shall be high performance stainless steel with mill finish, or warm edge to meet requirements in Performance Requirements article indicated herein and Section 084413

C. Glass Type A: Insulated “Low-E,” glass 1 inch thick units:
1. Components
   a. Outer layer: 1/4 inch (6 mm) thick heat-strengthened glass, Viracon Inc., color “Clear” with Low-E sputter coating on number 2 surface.
   b. Inner layer: 1/4 inch (6 mm) thick clear heat-strengthened glass.
   c. Air space: 1/2 inch (13 mm) thick.
      1) Gas fill: 90% Argon/10% Air.
2. Performance Requirements: Glass units shall be equal to Viracon “Solarscreen Low E Clear VE 1-2M”. having the following performance characteristics:
   a. Visible transmittance: 70 percent
   b. Shading coefficient: 0.43
   c. Relative heat gain: 89
   d. Solar transmittance: 33 percent
   e. Reflectance (Visible out): 11 percent
   f. Reflectance (Visible in): 12 percent
   g. Solar reflectance: 31 percent
   h. U Value (Winter / Summer): 0.25 / 0.21

D. Glass Type B: Insulated “Low-E,” glass 1 inch thick units with tempered glass:
1. Components
   a. Outer layer: 1/4 inch (6 mm) thick clear tempered glass with Low-E sputter coating on number 2 surface.
   b. Air space: 1/2 inch (13 mm) thick.

1) Gas fill: 90% Argon/10% Air.

c. Inner layer: 1/4 inch (6 mm) thick full tempered clear glass.

2. Performance Requirements: Same as Glass Type A.

E. Glass Type C: Insulated "Low-E," glass 1 inch thick units with fritted glass:

1. Components

a. Outer layer: 1/4 inch (6 mm) thick clear tempered glass with Low-E sputter coating over screened ceramic frit on the number 2 surface.

1) Ceramic Frit: Manufacturer's standard linear, symmetrical design with 50 percent coverage, in single custom color.

2. Air space: 1/2 inch (13 mm) thick.

a. Gas fill: 90% Argon/10% Air.

3. Inner layer: 1/4 inch (6 mm) thick clear heat strengthened glass with screened ceramic frit on the number 3 surface.

F. Glass Type D - Tempered safety glass: 1/4 inch thick at interior aluminum entry doors and storefront framing.

G. Glazing materials, including all sealant, tapes and gaskets, shall be as recommended by the storefront/entrance system manufacturer, and shall be in strict accordance with the manufacturer's printed instructions. It shall be the responsibility of the aluminum system manufacturer to provide glazing materials which are appropriate for the various uses and conditions, compatible with each other and also compatible with the materials with which in contact.

1. Continuous cushions beneath all glazing materials: Extruded dense EPDM rubber gaskets(60 +/- Shore A durometer), complying with ASTM C 864.

2. Continuous and recessed spacers: Extruded, closed-cell sponge neoprene or EPDM gaskets (40 +/- 5 Shore A durometer) complying with ASTM C 509.

## 2.11 FABRICATION

A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Engineer.

1. Check dimensions of openings for entrance and storefront systems in the actual construction by accurate field measurement before fabrication. When necessary to proceed with the fabrication without field measurements, coordinate and control installation tolerances to ensure proper fit of the aluminum entrance and storefront systems.

B. Factory / Shop Assembly: Before shipment, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble only for shipment and installation.

1. Except for application of hardware, do not use exposed fasteners. For hardware, use Phillips flat-head machine screws; match finish of member or hardware being fastened.
2. Do not drill and tap for surface-mounted hardware until installation.
3. Perform fabrication, including cutting, fitting, forming, drilling and grinding to prevent damage to exposed finish surfaces. For hardware, perform prior to application of finishes.
4. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.
5. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator.
6. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

C. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings

2.12 FINISHES

A. Factory Finish for Exposed Aluminum: Shop-applied Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 605.2, NAAMM - Metal Finishes Manual, and the following:

1. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product “Kynar 500” or Ausimont USA. product “Hylar 5000“.
2. Finish Coating shall be manufactured as one of the following products:
   a. Morton International; product “Fluoroceram”.
   b. P.P.G. Industries Inc.; product “Duranar”.
   c. Valspar Corp., product: “Fluropon”.
3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
4. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.
5. Shop finish with one color coat, of polyvinylidene flouride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.
6. Total system dry film thickness: 1.2 mils.
7. Colors and Appearance: Color shall be from storefront manufacturer's available library of non-exotic colors and shall match color sample furnished by Engineer.

B. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.

C. Isolation coating to cementitious and dissimilar materials: Apply one coat of bituminous paint or other acceptable coating to concealed aluminum surfaces in contact with cementitious and dissimilar materials

2.13 ACCESSORIES

A. All anchors and fasteners, including screws, nuts, bolts, rivets, and other fastening devices shall be of tempered aluminum or non-magnetic type 302/304 stainless steel, warranted by the manufacturer to be non-corrosive and compatible with aluminum frame members. All such devices shall be of suitable type and adequate capacity for each intended purpose.

1. Finished aluminum work shall generally be without use of exposed fasteners. Provide exposed fasteners only where acceptable to Engineer, finish to match surrounding aluminum.

B. Sealant and backing materials.

1. Sealant used within system: As recommended by manufacturer.
2. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
3. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section. Notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1. Beginning of installation means acceptance of project conditions.

B. Evaluation and Assessment:

1. Verify that field measurements are as indicated on shop drawings.

## 3.02 ERECTION

A. Coordinate the installation of the entrance and storefront systems, and related items to be furnished hereunder with the work of the other trades responsible for providing receiving and interfacing materials, and ensure that all receiving and supporting surfaces have been completed and ready to receive the work of this Section.

B. Perform the installation work in strict accordance with the approved shop drawings, and the manufacturers' installation instructions, and the herein-referenced standards. Erect the various systems and items plumb and true, in proper alignment and relation to established lines and grades.

C. All shims shall be aluminum. Wood shims will not be acceptable.

D. Provide sheet aluminum closures as indicated or required to complete the Work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install flashings and set thresholds in bed of mastic and secure.

G. Perform all glazing work in accordance with FGMA Glazing Manual SIGMA and LSGA standards, and with the entrance and storefronts framing system manufacturers' recommended glazing procedures.

1. All glass at entrance and storefront frames shall be set by use of resilient glazing gaskets between both interior and exterior stops and glass, weathertight, in strict accordance with the printed glazing instructions of the manufacturers of aluminum work and glazing materials.
2. All glass at aluminum doors shall be set by the use of resilient glazing gaskets provided on the glazing stops, in weathertight, in strict accordance with the printed glazing instructions of the manufacturer.

H. Ensure that all metal-to-metal and metal-to-glass joints are completely weathertight, and that adequate provisions have been made to permit expansion and contraction in the metal.

I. Except as required by code, no permanent exposed to view labels of any kind will be permitted to remain on the doors, frames or glass.

## 3.03 INSTALLATION - WET GLAZING

A. Utilize wet glazing methods for field installation of glass in exterior storefront systems.

B. Place setting blocks at quarter points on web of sill receiving member. Set glass unit in place with equal spaces on all sides.

C. Install spacers at a spacing not exceeding 24 inches apart uniformly around perimeter, between interior face of glass unit and the fixed glazing rabbet.

D. Apply a continuous heel bead of specified sealant between the outer edges if the glass unit and the web of the receiving member, in sufficient quantity to engage the leg of the applied glazing stop, when installed.

E. As the glazing stop is being applied, install spacers between the outer face of the glass unit and the stop, locating the spacers directly opposite the previously installed interior spacers. Install the glazing stops, ensuring that all clearances around the perimeter of the glass unit conform to the requirements of the respective standards referenced herein.

F. Apply a continuous bead of sealant around the exterior and interior perimeters, between the glass unit and the fixed rabbet, and between the glass unit and the applied glazing stop, extending the sealant material slightly above the sight line to permit proper tooling thereof.

G. Tool all exposed sealant at a 45 degree angle away from the glass surface, leaving the sealant surface uniformly dense and smooth.

H. Immediately remove all excess sealant from surfaces of metal and glass.

## 3.04 TOLERANCES

A. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Erect the aluminum entrance and storefront systems plumb and level, free of warp or twist.

1. Install 1/16 inch per 10 feet, non cumulative, maximum variation from plumb.
2. Install 1/32 inch maximum misalignment of two adjoining members abutting in plane.

## 3.05 ADJUSTING

A. Adjust doors and hardware for smooth operation and tight fit. Lubricate hardware and other moving parts.

B. Lubricate hardware and other moving parts.

## 3.06 CLEANING

A. Clean work under provisions of Section 01 74 13 – CLEANING UP.

1. Clean storefront system promptly after installation, exercising care to avoid damage. Thoroughly clean all metal surfaces free from dirt, handling marks, packing tapes, and foreign matter; remove excess sealant.
2. Remove labels from glass surfaces.
3. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess sealing compounds, mortar, paint, dirt, and other contaminants.

a. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.

## 3.07 PROTECTION

A. Protect finished work under provisions of Section 01 52 13 - TEMPORARY FACILITIES.

1. The manufacturer shall advise the Contractor of protective treatment and other precautions required by him through the remainder of construction to ensure that the work of this Section will be without damage or deterioration at the time of Substantial Completion of the Contract.

B. Repair Broken Glass:

1. Replace in kind and thickness all glass breakage caused by the work performed under this Section, and bear all costs therefor.
2. Replace in kind and thickness all glass breakage, caused by other trades, because of negligence or any other reasons, with the costs being borne by the trade at fault, or the Contractor, as applicable.

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SECTION 08 45 13

STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

## 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 aluminum-framed assemblies glazed with structured-polycarbonate panels as follows:

1. Wall assemblies.

### 1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

### 1.04 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 aluminum components of panel assemblies.

B. Shop Drawings: For panel assemblies.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.

C. Samples: In manufacturer's standard size.

1. For each type of structured-polycarbonate panel.
2. For each type of exposed finish for framing members.

D. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.

4. Structured-polycarbonate panels.
5. Flashing and drainage.

E. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For each structured-polycarbonate-panel assembly, for tests performed by a qualified testing agency.

C. Evaluation Reports: For structured-polycarbonate-panel assemblies from ICC-ES.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

## 1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

## 1.07 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical panel assemblies 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.

## 1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Water leakage.

2. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace structured-polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.

1. Defects include, but are not limited to, the following:

a. Delamination.
b. Color changes exceeding requirements.
c. Losses in light transmission beyond 6 percent from original when measured according to ASTM D1003.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
2. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design structured-polycarbonate-panel assemblies.

B. Structural Loads: As indicated on Drawings

C. Deflection Limits:

1. Vertical Panel Assemblies: Limited to L/175 of clear span for each assembly component.

D. Structural-Test Performance: Panel assemblies tested according to ASTM E330, as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
2. When tested at 165 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 15 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

F. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.

G. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations 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.

H. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:

1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.65 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar-Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas shall have an SHGC of no greater than .39 as determined according to NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..

## 2.02 STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

A. Structured-Polycarbonate-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with structured-polycarbonate panels.

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. Duo-Gard Industries Inc.
b. Gallina USA, LLC.
c. Kingspan Light + Air, North America.

## 2.03 STRUCTURED-POLYCARBONATE PANELS

A. Structured-Polycarbonate Panels: Translucent, extruded-polycarbonate sheet with multiwall cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.

B. Panel Thickness: Nominal 1-9/16” (40 mm)

C. UV Resistance: On both surfaces

D. Color: As selected by Architect from manufacturer's full range

E. Panel Performance:

1. Plastic Self-Ignition Temperature: 650 deg F or more according to ASTM D1929.
2. Smoke-Developed Index: 450 or less according to ASTM E84, or 75 or less according to ASTM D2843.
3. Combustibility Classification: Class CC1 based on testing according to ASTM D635.
4. Roof-Covering Classification: Class A according to ASTM E108 or UL 790.
5. Interior Finish Classification: Class A based on testing according to ASTM E84.
6. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.

    a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.

7. Impact Resistance: No failure at impact of [200 ft. x lbf according to freefalling-ball impact test using a 3-1/2-inch-diameter, 6.3-lb ball] <Insert requirements>.
8. Haze Factor: Greater than 90 percent when tested according to ASTM D1003.

## 2.04 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken, extruded aluminum

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429.
4. Structural Profiles: ASTM B308.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A193, 300 series stainless-steel screws.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

F. Anchor Bolts: ASTM A307, Grade A, galvanized steel.

G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than0.050-inch-thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.

J. Frame-System Sealants: As specified in Section 07 92 00 "Joint Sealants."

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.05 FABRICATION

A. Fabricate aluminum components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.

B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.

C. Reinforce aluminum components as required to receive fastener threads.

## 2.06 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, 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.

### 3.02 INSTALLATION

A. General: Comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install components plumb and true in alignment with established lines and elevations.

D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Install components to drain water passing through joints and moisture migrating within assembly to exterior.

E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

### 3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E1105.

a. Static-Air-Pressure Difference: 6.24 psf
b. Water Penetration: None.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

END OF SECTION

# SECTION 08 51 13
# ALUMINUM WINDOWS

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Prefinished extruded aluminum windows assemblies with fixed and projecting sash including operating hardware, insect screening, and all angles, clips, and other items required to anchor the systems to the building structure.
2. Prefinished miscellaneous formed aluminum closures, flashings, etc., in conjunction with aluminum windows.
3. Metal to metal sealing of aluminum assemblies.
4. All glass and glazing materials for aluminum windows, factory-installed to the fullest extent possible.
5. Shimming and fasteners required for installation.
6. Exterior perimeter sealant to abutting exterior materials.

1.02 EXAMINATION OF SITE AND DOCUMENTS

A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to ADVERTISEMENT FOR BIDS for time and date.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

B. Section 07 92 00 - JOINT SEALANTS: Interior perimeter sealant and back-up materials.

C. Section 08 45 13– INSULATED TRANSLUCENT PANEL ASSEMBLIES.

D. Section 08 80 00 - GLAZING: Glazing systems, other than the work described as part of this Section.

1.04 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. AAMA/WDMA/CSA 101/I.S.2/A440-05 - Standard Specifications for windows, doors and unit skylights.
2. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
4. AAMA 1503.1 - Specification for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
5. ASTM A 167 - Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
6. ASTM A 386 - Zinc Coating on Assembled Steel Products.
7. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
8. ASTM B 221 - Aluminum-alloy Extruded Bar, Rod, Wire, Shape, and Tube.
9. ASTM C 1036 - Flat Glass.
10. ASTM C 1048 - Heat-Treated Flat Glass.
11. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and vestibule, Curtains Walls and Doors.
12. ASTM E 330 Structural Performance of Exterior Entrance and vestibule, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
13. ASTM E 331 - Test method of Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
14. ASTM E 405 - Wear Testing Rotary Operators for Windows.
15. ASTM E 546 - Test Method For Frost Point of Sealed Insulating Glass Units.
16. ASTM E 576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
17. ASTM E 773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
18. ASTM E 774 - Sealed Insulating Glass Units.
19. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
20. FS RR-W-356A - Wire Fabric.
21. LSGA - Standards Manual.
22. Applicable recommendations and standards of the AA (Aluminum Association), SIGMA (Sealed Insulated Glass Manufacturers Association) and the FGMA (Flat Glass Marketing Association).
23.

## 1.05 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 – SUBMITTALS:

1. Literature: for each window assembly type: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder, including glass, window hardware and finish system.
2. Manufacturer's test data showing compliance with all specified performance requirements. Data shall be based on testing of windows units sized not less than those specified under the Article "Performance Requirements". Additionally:
3. Manufacturer's installation instructions, indicate special precautions required.
4. 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. Additionally include the following:
   a. Glass manufacturer's standard 10 year guarantee covering insulating glass.
5. Shop drawings:
   a. 1/4 inch scale elevations of each window.
   b. Large scale design details of each window type; indicating sizes, types, and gauges of all metal components; glazing details, indicating types and thickness of glass; bracing and stabilizing members; attachment clips and brackets; and complete installation details;
   c. Furnish all details bearing dimensions of actual measurements taken at the project.
6. Selection Samples:
   a. Sample card indicating Manufacturer's full range of coating colors available for selection by Engineer.
   b. Provide physical samples as requested by Engineer for initial selection of colors and finishes.
   c. Manufacturer's sample boards for sealant colors, for selections by the Engineer.
7. Verification samples:
   a. After receipt of selected colors from the Engineer, submit 12 inch long pieces of window framing components, prefinished in the specified finish system in each selected color.
   b. Submit sample of operating hardware.

B. Submit manufacturer's warranties under provisions of Section 01 78 00 –CLOSEOUT SUBMITTALS.

## 1.06 QUALITY ASSURANCE

A. The aluminum window assemblies shall be by a single recognized manufacturer specializing in and regularly engaged in, the production of aluminum work of type and quality specified. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not

to limit competition.

B. Perform work in accordance with AAMA 101.

C. Installer specializing in applying the work of this Section with a minimum of 3 years experience approved by product manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect pre-finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

B. Store framing and glazing materials in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

C. Sequence fabrication and deliveries to avoid delays in construction schedule, and to minimize time of on-site storage.

1.08 ENVIRONMENTAL CONDITIONS

A. Do not install sealant when ambient temperature is less than 40 degrees Fahrenheit.

B. Maintain this minimum temperature during and after installation of sealant.

1.10 FIELD MEASUREMENTS

A. Wherever practicable, check dimensions of openings in the actual framing work, by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress as directed by the Construction Manager. When necessary to proceed with the fabrication without field measurements, coordinate and control installation tolerances to ensure proper fit of the work of this Section.

B. Verify that field measurements are as indicated on approved shop drawings.

1.11 SEQUENCING AND SCHEDULING

A. Coordinate work of this Section with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.12 WARRANTY

A. Provide the following warranties under provisions of Section 01 78 00 – Project Closeout:

1. Total window assemblies: Manufacturer's written warranty for aluminum windows, covering repair or replacement of any unit which leaks, or exhibits defects in materials, finish, design, for a period of 10 years from date of substantial completion of the General Contract.
2. Insulating glass: Glass manufacturer's 10 year written warranty covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.
    a. Provide coverage in manufacturer's Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.
    b. Guarantee shall include replacement of defective glass and delivery of replacement glass furnished f.o.b. from point of manufacturer to project site.
3. Finish System Warranty: polyvinylidene flouride enamel finish 10 year coating warranty assigned specifically to project, covering film integrity (including chipping, crazing, pitting, and delamination), chalk resistance and color fading, color change.

## PART 2 - PRODUCTS

### 2.02 MANUFACTURER

A. Project-out windows with fixed lites: 4-1/2 inch depth frame (excluding depth of screen tracks and sill extensions), thermal barrier window with 2 inch deep vent. Acceptable products are:
    1. EFCO 2900 Series.
    2. Kawneer 8225T-L Series
    3. Wausau Metals 4250/FIX Series.

### 2.03 PERFORMANCE REQUIREMENTS

A. Fixed Windows:
    1. General: Conform to AAMA/WDMA/CSA 101/I.S.2/A440 requirements for minimum performance classification FW-AW100, for air leakage, water drainage, water penetration, uniform structural loading, and further requirements of all of the following.
    2. Test samples:
        a. Sample configuration: Refer to AAMA/WDMA/CSA 101/I.S.2/A440 Figure 28 and as defined in Paragraph 8.3.
        b. Sample(s) for air infiltration, water penetration and structural tests: Minimum unit size 5'-0" by 8'-3".

3. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 6.24 psf.
    a. Air infiltration shall not exceed 0.01 cfm per foot of sash crack length.
4. Water resistance: test in accordance with ASTM E331 and ASTM E547 at a static air pressure difference of 12.0 psf with result of no water leakage.
5. Uniform structural loading: test in accordance with ASTM E330 at a static air pressure difference of 150.0 psf (positive and negative) with result of no water leakage glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, or other damage which would cause the window to be inoperable.
6. Condensation resistance tests (CRF): Conform to AAMA 1503 for a minimum CRF of 71.
7. Thermal transmittance tests: Conform to NFRC 100 for a maximum conductive thermal transmittance "U-Value" of Uc 0.34.

B. Project Out Windows:
1. General: Conform to AAMA/WDMA/CSA 101/I.S.2/A440 requirements for minimum performance classification AP-AW100, for air leakage, water drainage, water penetration, uniform structural loading, and further requirements of all of the following.
2. Test samples:
    a. Sample configuration: Refer to AAMA/WDMA/CSA 101/I.S.2/A440 Figure 28 and as defined in Paragraph 8.3.
    b. Sample(s) for air infiltration, water penetration, thermal testing, and structural tests: Minimum unit size 5'-0" by 3'-0".
3. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 6.24 psf.
    a. For operating sash, closed and locked, air infiltration shall not exceed 0.10 cfm per foot of sash crack length.
4. Water resistance: Test in accordance with ASTM E331 and ASTM E547 at a static air pressure difference of 12.00 psf with result of no water leakage.
5. Uniform structural loading: Test in accordance with ASTM E330 at a static air pressure difference of 150.0 psf (positive and negative) with result of no water leakage glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, or other damage which would cause the window to be inoperable.
6. Condensation resistance tests (CRF): Conform to AAMA 1503 for a minimum CRF of 56.
7. Thermal transmittance tests: Conform to NFRC 100 for a maximum conductive thermal transmittance "U-Value" of Uc 0.52.

## 2.04 MATERIALS

A. All operable window sections shall be of extruded aluminum. Formed brake metal work shall be of sheet aluminum. Alloys and temper of aluminum shall be as recommended by manufacturer for strength, corrosion resistant, and specified finish, but of not less than 22,000 psi ultimate tensile strength.

B. Aluminum sections shall be factory prepared extrusions of sizes and profiles indicated on the approved shop drawing details; shall present straight, sharply defined lines and arises; and shall be free from defects impairing strength, durability, or appearance.

C. Frames specified as thermally-broken shall be equipped with positive, continuous, polyvinyl chloride or polyurethane thermal barrier placed between exterior and interior frame components to the exterior of the glass pane.

1. Frame depth: Calculation of specified frame depths shall not include screen tracks or sill extensions designed to accommodate screens.

D. All screws, nuts, bolts, rivets and other fastening devices shall be of tempered aluminum or non-magnetic, type 302/304 stainless steel, compatible with the aluminum frame members and other components of the window systems. All such devices shall be of suitable type and adequate capacity for each intended purpose. The aluminum work shall generally be constructed and erected without use of exposed fasteners; where exposed fasteners must be used, the fasteners shall be finished to match the finish of surrounding aluminum.

1. Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.
2. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

E. Sealant for use within the fabricated aluminum frames and for field sealing of the aluminum frame assemblies shall be type guaranteed by manufacturer for the joint size and movement to remain permanently elastic, non-shrinking and non-migrating.

## 2.05 FIXED WINDOWS

A. Frames/sash:

1. Frame and sash extrusion wall thickness: not less than 0.125 inch.

B. Sills: 0.125 inch thick extruded aluminum; sloped for positive wash; fit under sash leg to 1/2-inch beyond wall face; one-piece full width of opening.

## 2.06 PROJECTED-OUT WINDOWS

A. Frames/sash:

1. Frame and vent extrusion wall thickness: not less than 0.125 inch.

B. Hardware:

1. Locking handles, cam type and manufactured from a white bronze alloy with US26D brushed finish.
2. Weatherstripping: Double weather-stripped, “Santoprene” or equal.

B. Sills: 0.125 inch thick extruded aluminum; sloped for positive wash; fit under sash leg to 1/2-inch beyond wall face; one piece full width of opening.

## 2.07 ALUMINUM BRAKE-METAL AND PANNING WORK

A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the aluminum window as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, jamb and sill trim, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with aluminum windows.

1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable.
2. Provide sheet metal panning not less than 0.060 inch thick.
3. Fasten trim clips, at not more than 16 inches on center.

B. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent “oil canning” or deformation of the finished work. Material deemed defective by the Engineer will be replaced at no cost to the Owner.

## 2.08 GLASS AND GLAZING MATERIALS

A. Glass shall be of thickness and types scheduled in the Drawings and comply with the following:

1. 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.
2. 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 heat-tempering.
3. Glass thickness shown are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.

4. All insulating glass shall consists of two thickness of glass separated by a hermetically sealed dehydrated sealed air space complying with ASTM E 774-88 and conforming to Class CBA of Insulating Glass Certification Council.

B. Glass and Glazing Materials:

1. Glazing sealant: One-part high modulus clear silicone sealant, having a useful life expectancy of at least 30 years, GE Silglaze N, Dow-Corning 795 Silicone Building Sealant, Tremco Spectrem 2, or equal.
2. Compressible foam rod: Polyethelene foam rod, with bond-breaker surface, non gassing, fully compatible with silicone sealant, of appropriate sizes as recommended by the sealant manufacturer for the specific applications.

## 2.09 GLASS TYPES AND LOCATIONS

A. General: For locations of glass types, comply with the following descriptions and refer to Door Schedule, Interior Elevations and Exterior Elevations for additional locations, and as additionally noted on Drawings.

1. Glass type 4 - Insulated "Low-E" glass units:
   a. Typical all window locations.

B. Glass Type 4: Insulated "Low-E," clear glass 1 inch thick units:

1. Components
   a. Outer layer: 1/4 inch (6 mm) thick clear fully-tempered glass with Low-E sputter coating on number 2 surface.
   b. Inner layer: 1/4 inch (6 mm) thick clear fully-tempered glass.
   c. Air space: 1/2 inch (13 mm) thick.
      1) Gas fill: 100% Air
2. Performance Requirements: Glass units shall be Viracon "Solarscreen Radiant Low-E (VRE 1-59) Insulating Glass" having the following performance characteristics:
   a. Visible transmittance: 53 percent
   b. Shading coefficient: 0.39
   c. Relative heat gain: 81
   d. Solar transmittance: 28 percent
   e. Reflectance (Visible out): 30 percent
   f. Reflectance (Visible in): 19 percent
   g. Solar reflectance: 38 percent
   h. U Value (Winter / Summer): 0.30 / 0.27

## 2.10 INSECT SCREENS

A. Provide: Aluminum framed screen installed with two spring loaded steel pin plungers retainers.

1. Insect screening: FS RR-W-365A, woven 0.011 inch blackened aluminum in an 18 by 16 mesh size as manufactured by Phifer Wire Products, Tuscaloosa, AL, or approved equal.
2. Frame color: Custom as selected by Engineer.

## 2.11 ACCESSORIES

A. Receptor (sub-frame) Provide extruded aluminum receptors at heads and sills, where indicated on Drawings.

1. Receptor construction: Two piece, snap-together design, equipped with thermal break and weatherstripping.

B. Sealant stop trim: Provide manufacturer's standard sealant stop trim at exterior perimeter of all window frames/trim.

C. All anchors and fasteners, including screws, nuts, bolts, rivets, and other fastening devices shall be of tempered aluminum or non-magnetic type 302/304 stainless steel, warranted by the manufacturer to be non-corrosive and compatible with aluminum frame members and other components of the window assemblies. All such devices shall be of suitable type and adequate capacity for each intended purpose.

1. Finished aluminum work shall generally be without use of exposed fasteners. Provide exposed fasteners only where acceptable to Engineer, finish to match surrounding aluminum.
2. For application of hardware, use fasteners that match finish of framing/sash member or hardware being fastened, as appropriate.
3. Provide anchorage at location and spacing recommended by window manufacturer to comply with specified performance criteria.
4. Shims: Provide non-organic, non corrosive fully concealed shims as required to level and plumb window assemblies. Locate shims where recommended by window manufacturer.

D. Sealant and backer Materials

1. Sealant used within system: As recommended by manufacturer.
2. Exterior perimeter Sealant: Multi-component gun-grade polyurethane sealant Low modulus type, non-sagging, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT, M, A and O with a minimum movement capability of ±50 percent, equal to the following:
   a. Mameco International, Inc., product "Vulkem 922".
   b. Sonneborn Building Products Inc., Minneapolis MN; product, "Sonolastic NP2".

c. Tremco, Beachwood OH; product, “Dymeric”.

d. Pecora Corporation, Harleysville PA; product “Dynatrol II”.

3. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin foam or polyurethane foam rod, 1/3 greater in diameter than width of joint. Provide one of the following, or equal.

a. Nomaco, Inc., Zebulon NC; product “Foam Pak II”.

b. Sonneborn Building Products Inc., Minneapolis MN; product “Sonofoam”.

c. Tremco, Beachwood OH; product “Joint Backing”.

d. Applied Extrusion Technologies, Inc., Middletown DE, product “Sof Rod”.

4. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.

5. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

E. Sealant used within system (not used for glazing): As recommended by window manufacturer.

## 2.12 FABRICATION

A. Fabricate window units sized to properly fit each opening, allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal. Prepare window units ready to receive anchors, and furnished with all operating hardware. Engineer window units to fit the openings required without any cutting or fitting on the job site.

1. Rigidly fit joints and corner. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant. Ensure that joining method(s) do not discolor or damage finish.

2. Develop drainage holes with moisture pattern to exterior.

3. Prepare components to receive anchor devices. Fabricate anchorage items.

4. Permit internal drainage weep holes and channels to migrate moisture to exterior.

B. Factory glaze to the greatest extent possible. “Wet-Glaze” work in accordance with FGMA Glazing Manual SIGMA and LSGA standards for glazing and installations methods. Additionally:

1. Prior to installing glass, clean glazing channels and framing members.

2. Remove coatings not completely bonded to substrates.

3. Remove lacquer from metal surfaces where in contact with glazing sealant.

4. Protect glass from edge damage at all times. Utilize roller blocks and suction cups.

5. Replace glass from edge damage or other imperfections which would weaken glass.
6. Install setting and side blocks in locations recommended by referenced standards.
7. Center glass in openings. Provide minimum bite and clearances as recommended by referenced standards. Install in manner to permit easy replacement of glass without dismantling frames.
8. Prevent metal to glass contact al all locations. Protect edges of insulated units from moisture and solvents.
9. Clean, prime and install stops.

C. Assemble insect screens of rolled aluminum rectangular sections. Miter and reinforce frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.

D. Double weatherstrip operable units.

2.13 FINISHES

A. Exposed aluminum: Aluminum: Shop-applied Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 605.2, NAAMM - Metal Finishes Manual, and the following:
1. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product “Kynar 500” or Ausimont USA. product “Hylar 5000”.
2. Finish Coating shall be manufactured as one of the following products:
a. Akzo Chemical; product “Trinar”.
b. Glidden Company; product “Nubelar”.
c. Morton International; product “Fluoroceram”.
d. PPG Industries Inc.; product “Duranar”.
e. Valspar Corp., product: “Fluropon”.
3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
4. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 1.0 to 1.3 mils dry film thickness, fully oven-cured.
5. Shop finish with one color coat, of polyvinylidene flouride enamel averaging 1.0 to 1.3 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings
6. Color and Appearance: Color shall be from paint manufacturer's available library of all colors and including metallics and exotic colors.
a. Gloss: Medium, measured by ASTM D523, 35±5 at 60 degrees Fahrenheit.

B. Operator: Enameled to color as selected by Engineer from manufacturer's standard options.

C. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.

D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.14 SCAFFOLDS AND STAGING

A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.

1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.15 HOISTING MACHINERY AND EQUIPMENT

A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

## PART 3 - EXECUTION

3.02 EXAMINATION

A. Inspect all surfaces and verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

B. Beginning of installation means acceptance of existing conditions.

## 3.03 INSTALLATION

A. Install aluminum windows in accordance with the manufacturers' installation instructions, and the herein-referenced standards.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align windows plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Coordinate attachment and seal of perimeter air and vapor barrier materials.

G. Install operating hardware.

H. Perform glazing work in accordance with FGMA Glazing Manual SIGMA and LSGA standards for glazing and installations methods.

I. Ensure that all metal-to-metal and metal-to-glass joints are completely weatherproof, and that adequate provisions have been made to permit expansion and contraction in the metal.

J. No permanent exposed to view labels of any kind will be permitted to remain on frames or glass.

## 3.04 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 feet non-cumulative or 1/16 inch per 10 feet, whichever is less.

1. Do not add this tolerance to other allowable tolerances for related work.

## 3.05 ADJUSTING

A. Adjust operable sash and hardware for smooth operation and tight fit of sash. Lubricate hardware and other moving parts.

B. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces with shop-coat finish material, supplied with the various items to be furnished hereunder.

## 3.06 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

B. Remove excess sealant by solvent acceptable to sealant manufacturer. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.

C. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess sealing compounds, mortar, paint, labels, dirt, and other contaminants.

D. Remove protective material from prefinished aluminum surfaces. Wash down exposed surfaces free of dirt, handling marks, packing tapes, and foreign matter, using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

## 3.07 PROTECTION

A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection; advise the Construction Manager of protective treatment and other precautions required through the remainder of construction.

B. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.

C. Cover glass To protect it from activities that might abrade the glass surface.

## 3.08 GLASS BREAKAGE

A. Replace in kind and thickness all glass breakage caused by the work performed under this Section and bear all costs therefore.

B. Replace in kind and thickness all glass breakage, caused by other trades, because of negligence or any other reasons, with the costs being borne by the trade at fault, or the Construction Manager, as applicable.

END OF SECTION

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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 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Stainless Steel Doors and Frames”.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

## 1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

## 1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

## 1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual overhead door closer bodies.

4. Two years for electromechanical door hardware, unless noted otherwise.

## 1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

# PART 2 - PRODUCTS

## 2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.

b. Sizes from 3’1” to 4’0”: 5” heavy weight.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, stainless steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, stainless steel,ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate otherwise.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. Bommer Industries (BO).
b. Hager Companies (HA).
c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. Bommer Industries (BO).
b. Hager Companies (HA).
c. Pemko (PE).

## 2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Hager Companies (HA) - ETW-QC (# wires) Option.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with

Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Pemko (PE) - EL-CEPT Series.
    b. Securitron (SU) - EL-CEPT Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. Hager Companies (HA) - Quick Connect.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC-C Series.

## 2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

    a. Door Controls International (DC).
    b. Rockwood (RO).
    c. Trimco (TC).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Rockwood (RO).
c. Trimco (TC).

## 2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

D. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Removable Cores: Provide removable cores as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

F. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

G. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

H. Construction Keying: Provide construction master keyed cylinders.

I. Construction Keying: Provide temporary keyed construction cores.

J. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

## 2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.

2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ML2000 Series.
    b. Sargent Manufacturing (SA) - 8200 Series.
    c. Schlage (SC) - L9000 Series.

## 2.8 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below and in the hardware sets.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ML20900 Series.
    b. Sargent Manufacturing (SA) - 8200 Series.
    c. Schlage (SC) - L9000 EL/EU/RX Series.

## 2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Short-lipped strikes: For locks at double doors.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with keyed cylinder dogging device to hold the pushbar and latch in a retracted position.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Extended cycle test: Devices to have been cycle tested to 9 million cycles.

11. Rail Sizing: Provide exit device rails factory sized for proper door width application.

12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions

specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    b. Sargent Manufacturing (SA) - 80 Series.
    c. dormakaba Precision (PR) - Apex 2000 Series.

## 2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC6000 Series.
    b. Norton Rixson (NO) - 7500 Series.
    c. Sargent Manufacturing (SA) - 351 Series.

## 2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Hiawatha, Inc. (HI).
   b. Rockwood (RO).
   c. Trimco (TC).

## 2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Hiawatha, Inc. (HI).
   b. Rockwood (RO).
   c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function. Provide low-profile stops where conflict occurs with aluminium door construction.

1. Manufacturers:

a. Norton Rixson (RF).
b. Rockwood (RO).
c. Sargent Manufacturing (SA).

## 2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies 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 according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

## 2.15 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

   a. Sargent Manufacturing (SA) - 3280 Series.
   b. Security Door Controls (SD) - DPS Series.
   c. Securitron (SU) - DPS Series.

B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

2. Manufacturers:

   a. Securitron (SU) - AQL Series.
   b. Altronix (AS) - Maximal 11F.

## 2.16 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.17 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9

Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

## 3.4 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.

## 3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

## 3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

## 3.7 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. SU - Securitron
6. OT - Other

**Hardware Sets**

**Set: 1.0**
Description: Exterior; Vestibule Alum - Card Access

| | | | | |
|---|---|---|---|---|
| 1 | Continuous Hinge | CFM-HD1 EL-CEPTx32D | | PE |
| 1 | Fail Secure Lock | RX 72 8271 LNL | US32D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Concealed Overhead Stop | 690S Series | EN | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Threshold (coord w/ details) | 274x292AFGPK FHSL14SS | | PE |
| 1 | Door Wiring Harness | QC Series (jamb to device) | | MK |
| 1 | Frame Wiring Harness | QC Series (jamb to J-box) | | MK |
| 1 | Position Switch (concealed) | DPS Series | | SU |
| 1 | Power Supply | AQL4-R8-E1 | | SU |
| 1 | Weather/Perimeter Seals | Supplied with door/frame assembly | | 00 |
| 1 | Card Reader | By Security Vendor | | 00 |

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

**Set: 2.0**
Description: Exterior Shop; Storage - Card Access

| | | | | |
|---|---|---|---|---|
| 2 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Hinge (hvy wgt, 12-conductor) | T4A3386 QC12 (size per spec) | US32D | MK |
| 1 | Fail Secure Lock | RX 72 8271 LNL | US32D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Surface Overhead Stop | 590S Series | EN | SA |
| 1 | Concealed Overhead Stop | 690S Series | EN | SA |
| 1 | Surface Closer (offset) | 351 PD10 | EN | SA |

| | | | |
|---|---|---|---|
| 1 | Threshold (coord w/ details) | 274x292AFGPK FHSL14SS | PE |
| 1 | Head & Jamb Seal | 2891APK | PE |
| 1 | Sweep | 315CN | PE |
| 1 | Door Wiring Harness | QC Series (jamb to device) | MK |
| 1 | Frame Wiring Harness | QC Series (jamb to J-box) | MK |
| 1 | Position Switch (concealed) | DPS Series | SU |
| 1 | Power Supply | AQL4-R8-E1 | SU |
| 1 | Card Reader | By Security Vendor | 00 |

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

**Set: 3.0**
Description: Exterior Washbay - Hold Open

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Storeroom Lock (32D) | 72 8204 LNL | US32D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Surface Overhead Holder/Stop | 590H Series | EN | SA |
| 1 | Surface Closer (offset) | 351 PD10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Threshold (coord w/ details) | 274x292AFGPK FHSL14SS | | PE |
| 1 | Head & Jamb Seal | 2891APK | | PE |
| 1 | Sweep | 315CN | | PE |
| 1 | Position Switch (concealed) | DPS Series | | SU |

**Set: 4.0**
Description: Exterior Exit Hardware

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Exit Lock | 72 8206 LNL | US32D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Surface Overhead Stop | 590S Series | EN | SA |
| 1 | Surface Closer (offset) | 351 PD10 | EN | SA |
| 1 | Threshold (coord w/ details) | 274x292AFGPK FHSL14SS | | PE |
| 1 | Head & Jamb Seal | 2891APK | | PE |
| 1 | Sweep | 315CN | | PE |
| 1 | Position Switch (concealed) | DPS Series | | SU |

**Set: 5.0**
Description: Wet Area - Card Access

| | | | | |
|---|---|---|---|---|
| 2 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Hinge (hvy wgt, 12-conductor) | T4A3386 QC12 (size per spec) | US32D | MK |
| 1 | Fail Secure Lock | RX 72 8271 LNL | US32D | SA |

| | | | | |
|---|---|---|---|---|
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Concealed Overhead Stop | 690S Series | EN | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Threshold (coord w/ details) | 271A FHSL14SS | | PE |
| 1 | Head & Jamb Seal | 2891APK | | PE |
| 1 | Sweep | 315CN | | PE |
| 1 | Door Wiring Harness | QC Series (jamb to device) | | MK |
| 1 | Frame Wiring Harness | QC Series (jamb to J-box) | | MK |
| 1 | Position Switch (concealed) | DPS Series | | SU |
| 1 | Power Supply | AQL4-R8-E1 | | SU |
| 1 | Card Reader | By Security Vendor | | 00 |

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

**Set: 6.0**
Description: Wet Area - Card Access (both directions)

| | | | | |
|---|---|---|---|---|
| 2 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Hinge (hvy wgt, 12-conductor) | T4A3386 QC12 (size per spec) | US32D | MK |
| 1 | Fail Secure Lock (both directions) | LX 72 8273 LNL | US32D | SA |
| 2 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Concealed Overhead Stop | 690S Series | EN | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Threshold (coord w/ details) | 271A FHSL14SS | | PE |
| 1 | Head & Jamb Seal | 2891APK | | PE |
| 1 | Sweep | 315CN | | PE |
| 1 | Door Wiring Harness | QC Series (jamb to device) | | MK |
| 1 | Frame Wiring Harness | QC Series (jamb to J-box) | | MK |
| 1 | Position Switch (concealed) | DPS Series | | SU |
| 1 | Power Supply | AQL4-R8-E1 | | SU |
| 1 | Card Reader | By Security Vendor | | 00 |

Notes:
Operation: Door is normally closed and locked. Valid card at reader (from either direction) unlocks lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Lock status will not change when the fire detection/suppression systems are activated. Outside key override (both directions).

**Set: 7.0**
Description: Office w/ Classroom Lock

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise, Hvy Wt | T4A3786 (qty, size, nrp per spec) | US26D | MK |

| | | | | |
|---|---|---|---|---|
| 1 | Classroom Lock | 72 8237 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 8.0**
Description: Maintenance - Classroom Lock; Door Contact

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Classroom Lock | 72 8237 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |
| 1 | Position Switch (concealed) | DPS Series | | SU |

**Set: 9.0**
Description: Multi-Purpose w/ Office Lock

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise, Hvy Wt | T4A3786 (qty, size, nrp per spec) | US26D | MK |
| 1 | Office/Entry Lock | 72 8205 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 10.0**
Description: Closet Pair - Passage

| | | | | |
|---|---|---|---|---|
| 6 | Hinge, Full Mortise, Hvy Wt | T4A3786 (qty, size, nrp per spec) | US26D | MK |
| 1 | Dust Proof Strike | 570 | US26D | RO |
| 2 | Flush Bolt | 555 | US26D | RO |
| 1 | Passage Set | 8215 LNL | US26D | SA |
| 2 | Surface Overhead Stop | 1540S Series | EN | SA |
| 2 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 2 | Silencer | 608 | | RO |

**Set: 11.0**
Description: Single User Toilet; Lockers

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2314 (qty, size, nrp per spec) | US32D | MK |
| 1 | Privacy Lock | V21 8265 LNL | US26D | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 12.0**
Description: Locker Room; Restroom

| | | | | |
|---|---|---|---|---|
| 3 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Push Pull | 111x73C/73CL | US32D | RO |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 2 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 13.0**
Description: Electrical

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise | TA2314 (qty, size, nrp per spec) | US32D | MK |
| 1 | Exit Device (rim, storeroom) | 12 72 8846 ETL | US32D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 14.0**
Description: Single - Card Access

| | | | | |
|---|---|---|---|---|
| 2 | Hinge, Full Mortise, Hvy Wt | T4A3786 (qty, size, nrp per spec) | US26D | MK |
| 1 | Hinge (hvy wgt, 12-conductor) | T4A3786 QC12 (size per spec) | US26D | MK |
| 1 | Fail Secure Lock | RX 72 8271 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |
| 1 | Door Wiring Harness | QC Series (jamb to device) | | MK |
| 1 | Frame Wiring Harness | QC Series (jamb to J-box) | | MK |
| 1 | Position Switch (concealed) | DPS Series | | SU |
| 1 | Power Supply | AQL4-R8-E1 | | SU |
| 1 | Card Reader | By Security Vendor | | 00 |

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

**Set: 15.0**
Description: Classroom Storage; Janitor

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise, Hvy Wt | T4A3786 (qty, size, nrp per spec) | US26D | MK |
| 1 | Classroom Lock | 72 8237 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 16.0**
Description: Bldg Services; Storage

| | | | | |
|---|---|---|---|---|
| 3 | Hinge, Full Mortise, Hvy Wt | T4A3786 (qty, size, nrp per spec) | US26D | MK |
| 1 | Storeroom Lock | 72 8204 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 1 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 1 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 3 | Silencer | 608 | | RO |

**Set: 17.0**
Description: Bldg Services; Storage Pair

| | | | | |
|---|---|---|---|---|
| 6 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Dust Proof Strike | 570 | US26D | RO |
| 2 | Flush Bolt | 555 | US26D | RO |
| 1 | Storeroom Lock | 72 8204 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 2 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 2 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 1 | Head & Jamb Seal (adhesive) | S88BL (provide for fire rated doors) | | PE |
| 1 | Astragal (flatbar) | 357SP (HM); 357SS (WD) | | PE |
| 1 | Astragal (adhesive, edge mount) | S772C | | PE |
| 2 | Silencer | 608 | | RO |

**Set: 18.0**
Description: Storage Pair - Door Contacts

| | | | | |
|---|---|---|---|---|
| 6 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Dust Proof Strike | 570 | US26D | RO |
| 2 | Flush Bolt | 555 | US26D | RO |
| 1 | Storeroom Lock | 72 8204 LNL | US26D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 2 | Kick Plate | K1050 8" 4BE CSK | US32D | RO |
| 2 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 1 | Astragal (flatbar) | 357SP (HM); 357SS (WD) | | PE |
| 2 | Silencer | 608 | | RO |
| 2 | Position Switch (concealed) | DPS Series | | SU |

**Set: 19.0**
Description: Stainless Steel Washbay Equipment Pair

| | | | | |
|---|---|---|---|---|
| 6 | Hinge (heavy weight) | T4A3386 (qty, size, nrp per spec) | US32D | MK |
| 1 | Dust Proof Strike | 570 | US26D | RO |
| 2 | Flush Bolt | 555 | US26D | RO |
| 1 | Storeroom Lock (32D) | 72 8204 LNL | US32D | SA |
| 1 | Small Format Inter Core | 7300B CKC GMK | US15 | SA |
| 1 | Door Closer | 351 O; P10 | EN | SA |
| 2 | Door Stop | 404 wall; 441CU floor; or per spec | US26D | RO |
| 1 | Astragal | 357SS | | PE |
| 2 | Silencer | 608 | | RO |

**Set: 20.0**
Description: Overhead Door

| | | | |
|---|---|---|---|
| 1 | Hardware | Supplied with door assembly | OT |

END OF SECTION 087100

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SECTION 08 80 00

GLAZING

## 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. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

### 1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

### 1.04 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

### 1.05 PREINSTALLATION MEETINGS

A. Preinstallation 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. Review temporary protection requirements for glazing during and after installation.

## 1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1. Tinted glass.
2. Coated glass.
3. Laminated glass.
4. Insulating glass.
5. Spandrel glass.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

## 1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturers of fabricated glass units, glass testing agency and sealant testing agency.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

## 1.08 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal

(AG&M) contractors[ and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program].

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 08 51 13 "Aluminum Windows" to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.09 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than two (2) Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

## 1.010 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## 1.011 FIELD 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.012 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

## 2.02 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: As indicated on Drawings
    c. Importance Factor: As indicated on Drawings
    d. Exposure Category: As indicated on Drawings

2. Design Snow Loads: As indicated on Drawings.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

## 2.03 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."

3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: ¼”
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.04 GLASS PRODUCTS

A. Glass types and locations:

1. General: For locations of glass types, comply with the following descriptions and refer to Door Schedule, Interior Elevations and Exterior Elevations for additional locations, and as additionally noted on Drawings.
   a) Glass type 4 - Insulated “Low-E” glass units:
      a. Typical all window locations, except where others are indicated.
2. *Glass Type 1* – Clear tempered safety glass: 1/4 inch thick.
3. *Glass Type 2*: Nominal 1/4 inch thick laminated glass.
   a) Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
   b) Interlayer: 0.030 inch thick translucent clear polyvinyl butyl innerlayer
   c) Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass.
4. *Glass Type 3*: 8mm-9 mm thick (5/16 inch-3/8 inch) transparent wire-less fire rated ceramic glazing material with polished finish.
   a) Acceptable Manufacturers: Subject to compliance with the requirements
   b) Specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

a. Nippon Electric Glass Co., Ltd., “Firelite Plus”.
b. Vetrotech Saint-Gobain, “SSG Keralite FR-L”.
c. SAFTI First, “Pyran Platinum L”.

c) For fire rated door assemblies, conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257.
- Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings. Permanently identify each individual glazing unit with a listing mark visible after

d) Installation.
- In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.

5. *Glass Type 4*: Insulated “Low-E,” glass 1 inch thick units:

a) Components
a. Outer layer: 1/4 inch (6 mm) thick tempered glass, Viracon Inc., color “Clear” with Low-E sputter coating on number 2 surface.
b. Inner layer: 1/4 inch (6 mm) thick clear tempered glass.
c. Air space: 1/2 inch (13 mm) thick.
d. Gas fill: 90% Argon/10% Air.

b) Performance Requirements: Glass units shall be equal to Viracon “Solarscreen Low E Clear VE 1-2M”. having the following performance characteristics:

- Visible transmittance: 70 percent
- Shading coefficient: 0.43
- Relative heat gain: 89
- Solar transmittance: 33 percent
- Reflectance (Visible out): 11 percent
- Reflectance (Visible in): 12 percent
- Solar reflectance: 31 percent
- U Value (Winter / Summer): 0.25 / 0.21

6. *Glass Type 5*: Frosted tempered safety glass, ¼ inch thick.

## 2.05 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 150/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

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. Pecora Corporation.
b. Sika Corporation.
c. Tremco Incorporated.

2. Applications: Exterior Glazed Doors & Lites

C. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

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. Pecora Corporation.
b. Sika Corporation.
c. Tremco Incorporated.

2. Applications: Interior Glazed Doors & Lites

## 2.06 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.07 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Neoprene with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Neoprene with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.08 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

## 3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

## 3.05 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

## 3.06 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

## 3.07 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

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SECTION 08 91 19

FIXED LOUVERS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes fixed extruded-aluminum louvers complete with aluminum wire mesh bird screens and related items.

B. Related Requirements:
   1. Section 04 20 00 – UNIT MASONRY: Coordinating openings in the cmu wall for louvers.
   2. Section 07 92 00- JOINT SEALANTS: Providing Perimeter sealant and backing materials.
   3. Section 13 42 00 – PRE-ENGINEERED METAL BUILDING: Coordinating openings in the metal building and girt back-up structure.
   4. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
      1. Furnishing and installing motorized dampers.
      2. Blank-off plates on back side of louvers.
   5. Division 26 – ELECTRICAL:
      1. Power supply to motorized louvers.
      2. Connections to control terminals for smoke detection devices and fire alarm system activation of louver.

### 1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

   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.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural [and seismic] performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Sample warranties.

## 1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## 1.05 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Structural Drawings.

C. Seismic Performance: As indicated on drawings.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

## 2.02 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Airolite Company, LLC (The).
   b. All-Lite Architectural Products.
   c. Greenheck Fan Corporation.

2. Louver Depth: 6 inches
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

   a. Free Area: Not less than 7.0 sq. ft for 48-inch- wide by 48-inch- high louver.
   b. Point of Beginning Water Penetration: Not less than 900 fpm
   c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area velocity.
   d. Air Performance: Not more than 0.15-inch wg static pressure drop at 900-fpm free-area velocity.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.03 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening & Insect screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

C. Louver Screening for Aluminum Louvers:

1. Bird Screening: Stainless steel, 1/2-inch- square mesh, 0.047-inch wire.
2. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.

D. Louver Screening for Galvanized-Steel Louvers:

## 2.04 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A653/A653M, G60zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A240/A240M, Type 304

E. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

F. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.05 FABRICATION

A. 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.

B. Join frame members to each other and to fixed louver blades with fillet welds threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.06 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Locate and place louvers 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. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized- and nonferrous-metal surfaces that are 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.

### 3.02 ADJUSTING

A. Restore louvers 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.

END OF SECTION

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SECTION 09 05 06

COMMON WORK RESULTS FOR FLOORING

## PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.01 SUMMARY

A. This Section includes general requirements for flooring preparation, installation and temporary protection for flooring systems.

1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
2. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
   a. Grinding down high spots of substrate.
   b. Providing Portland cement-based latex underlayment (filler).

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.

B. Section 09 65 13 – RESILIENT BASE AND ACCESSORIES.

B. Section 09 65 23 – RUBBER FLOORING.

C. Section 09 65 43 – LINOLEUM FLOORING.

C. Section 09 67 23 - RESINOUS FLOORING.

D. Section 09 68 13 – TILE CARPETING.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM D 4259 - Standard Practice for Abrading Concrete.

2. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
3. ASTM E 1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
4. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM F 1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
6. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
7. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
8. ASTM F 3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 19.23 – CONSTRUCTION MEETINGS. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees:
   a. Engineer.
   b. General Contractor.
   c. Project Superintendents representing each floor system installer.
   d. Manufacturer's technical representative(s) for flooring products as designated by Engineer or Contractor.
   e. Representatives of related trades as directed by the Engineer or Contractor, and representatives for installers of related work specified under the following Sections:
      1) Section 09 65 23 – Rubber Flooring.
      2) Section 09 65 43 – Linoleum Flooring.
      3) Section 09 67 23 - Resinous Flooring.
      4) Section 09 68 13 – Tile Carpeting.
2. Agenda:

a. Scheduling of preparation and flooring operations.

b. Procedures for testing of relative humidity and moisture content of in situ substrates.

c. Water vapor emission control methods.

d. Review of staging and material storage locations.

e. Coordination of work by other trades.

f. Protection of completed Work.

g. Establish humidity and temperature limitations for performing the work, to which Engineer and Contractor must agree.

h. Discuss process for inspection and acceptance of completed Work of this Section.

C. Sequencing:

1. Sequence work to ensure flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.

2. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

3. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Test and Evaluation Reports: Include the following:

a. Report the Test Deployment Parameters at start of testing and finishing of testing:

1) Start and finish dates and times of testing.

2) Ambient temperature,

3) Ambient relative humidity and dew point temperature.

4) Minimum and maximum ambient temperature and relative humidity reached during testing.

b. Report the "Factor" used to calculate the actual test area of the Calcium Chloride test site.

c. Report the concrete slab thickness (in inches).

d. Report all test results in chart form listing the following:

1) Test locations (also mark test locations on floor plan)

2) Surface Temperature of Concrete

3) pH Paper/ Pencil Reading (ASTM F 710)

4) Visual Appearance of Concrete
5) Concrete Slab Age
6) Relative Humidity in Concrete, % (ASTM F 2170):
   a) Depth of hole from top of Slab, in.
   b) RH in concrete, %
   c) Temp. in concrete, °F
7) Surface Moisture Meter Test (ASTM E 1907):
   a) 1. Electrical Impedance Test Values or
   b) 2. Electrical Resistance Test Values
8) Moisture Vapor Emission (MVER) - CaC12 Test (ASTM F 1869):
   a) Weight Gain in grams
   b) Exposure Time/hrs
   c) MVER lbs./1,000 sq. ft./24 hours

e. Report all unacceptable substrate and field conditions observed during testing.

B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

1.06 QUALITY ASSURANCE

A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) testing for concrete slabs and floors.

1. Contractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the Contractor, flooring subcontractors and Owner's Project Representative.

   a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
      1) Resinous flooring and seamless flooring of all types.
      2) Painted floors and concrete sealers.
      3) Carpet tile.

   b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.

2. Testing Requirements: As specified under Part 3 of this Section.

   a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.
      1) Perform additional testing after procedures have been performed by the Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.

## PART 2 - PRODUCTS

2.01 GENERAL FLOORING ACCESSORIES

A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:

1. Ardex Americas, Aliquippa, PA., products “Feather Flash” and “Ardex SD-P”.
2. Quikrete Companies., Atlanta, GA., product “Fast-Set Underlayment 1248”.
3. Silpro Corp., Ayer MA., product “Profinish”.

B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):

1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
   a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
   b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   c. VOC content: Less than 50 g/L.
2. Acceptable manufacturers, or approved equal:
   a. Advanced Adhesive Technology, Inc, Dalton GA.
   b. DAP Incorporated, Dayton OH.
   c. W.W. Henry Company, Aliquippa PA.
   d. Roberts Consolidated Industries, Inc., City of Industry, CA.
   e. Or adhesive recommended by flooring manufacturer for performance and compliance with warranty requirements.

2.02 TESTING EQUIPMENT

A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
   a. Minimum 2 point probe calibration.

B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.

C. For pH testing: In compliance with ASTM F710.

1. pH test paper.
2. Distilled or de ionized water.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:

1. Substrates shall be dry and clean.
2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual flooring Specification Sections.
4. Temperature of flooring and substrate shall be within specified tolerances as required by flooring and adhesive manufacturers.
5. Moisture condition and adhesive bond tests shall be performed as specified herein.

B. For applications on concrete:

1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

### 3.02 SURFACE PREPARATION FOR TESTING

A. General: Substrates shall be dry and clean. Remove all dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.

1. Non- chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.

B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.

## 3.03 TESTING IN SITU CONCRETE SUBSTRATES

A. Scope:

1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.

B. Scheduling:

1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
   a. DO NOT conduct testing unless the slab environment is identical to that In which the finished flooring Is to be installed.

C. Test result submittals:

1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
2. List test locations on chart and show same on marked up Floor Plan Drawings.
3. Submit results In duplicate. Deliver copies directly to Engineer, Owner's Project Representative and Construction Manager General Contractor.

D. Testing Procedures, quantification of Relative Humidity

1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be Included with the test report.
2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the inserted test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
   a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
   b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
4. Vacuum all concrete dust from test hole.

5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
9. Read and record temperature and relative humidity at the test site.

E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:

1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 In the first 1,000 square feet and I per each additional 1,000 square feet.
3. Tests sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
5. Expose Calcium Chloride and set dish on concrete surface.
6. Install test containment dome and allow test to proceed for 60 to 72 hours.
7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
8. Weigh test dish on site recording weight and stop time.
9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."

F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:

1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
   a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.
   b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
   c. Allow the water to set for approximately 60 seconds.

d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading

2. Record and report results.

G. Testing Procedures:

1. Initial testing: Provide 3 tests for the first 1,000 square feet.
2. Add one test for each additional 1,000 square feet.
3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
6. After completion of tests submit 2 copies of test data to the Engineer. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

## 3.04 FLOORING PREPARATION – GENERAL REQUIREMENTS

A. Close spaces to pedestrian and worker traffic during the installation of the flooring.

B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.

1. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
2. Remove, by light sanding and grinding, all protruding edges, high spots.
3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
4. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
5. For concrete substrates:
   a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
   b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.

C. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.

D. Apply primers as recommended by adhesive manufacturer's written instructions.

E. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

3.05 FLOORING INSTALLATION GENERAL

A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.

1. Apply primers as recommended by adhesive manufacturer's written instructions.

3.06 ADHESIVE BOND TESTING

A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1,000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Engineer.

3.07 PROTECTION

A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

## PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section consists of non-load bearing metal framing for partitions, ceilings, and soffits, where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.

B. Furnish and install:

1. Metal furring and framing where indicated on the Drawings, including cross bracing and knee bracing.
2. Metal ceiling and soffit framing.
3. Metal ceiling and soffit framing, including hanger attachments, wire hangers, and screwable metal tee grid system.
4. Reinforcing plate blocking.
1. Cellular PVC sills where indicated.
2. Deflection track assemblies at tops of metal stud partitions.
   a. Provide fire-rated assemblies at fire-rated, corridor, and smoke partitions.
   b. Provide non fire-rated assemblies at all other partitions.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY:

1. Wood blocking.
2. Installation of metal door frames in gypsum board work.

B. Section 07 21 00 - THERMAL INSULATION.

C. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.

D. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.

E. Section 09 29 00 - GYPSUM BOARD:

1. Gypsum board, applied over metal framing installed under this Section 09 22 16, including: gypsum board, and related trim components.
2. Shaft wall system including framing components, shaft wall liner and gypsum board finish.

F. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling, including metal suspension system.

G. Section 13 42 00 – PRE-ENGINEERED METAL BUILDING.

H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.

I. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM C 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
2. ASTM C 645 - Non-Load Bearing Steel Studs, Runners, and Rigid Furring Channels for Screw Application of Gypsum Board.
3. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
4. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard.
5. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
6. ASTM E 119 - Fire Tests of Building Construction and Materials.
7. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum board.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work
2. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD to assure the steady progress of the Contract.

1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.06 QUALITY ASSURANCE

A. General: Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer.

C. Qualifications:

1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, surface contamination, corrosion and damage from construction operations and other causes.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Metal components and related items (including non-rated deflection track assemblies):
   a. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
   b. Marino\Ware, Division of Ware Industries, South Plainfield NJ.
   c. Cemco Steel Framing and Metal Lath, City of Industry, CA.
   d. Telling Industries, Mentor, OH.
   e. Super Stud Building Products, Inc., Edison NJ.
2. Fire rated deflection track assemblies:
   a. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
   b. Cemco Steel Framing and Metal Lath, City of Industry, CA.

c. The Steel Network, Inc., Durham, NC.

d. Fire Trak Inc., Watkins, MN.

3. Suspended furring system for ceilings and soffits:

a. Armstrong World Industries, Inc., Lancaster, PA.

b. Chicago Metallic Corporation, Chicago IL.

c. USG Corporation, Chicago IL.

B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

## 2.02 DESCRIPTION

A. Regulatory Requirements

1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.

2. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.

a. Fire-Test-Response Characteristics: Provide components that comply with rating requirements specified for fire-rated assemblies under UL 2079 for non-load bearing wall systems.

1) Deflection Clips and Firestop Track: Connections and/or top runner provided in fire-resistance-rated assemblies shall be certified by UL 2079 for cyclic movement requirements.

## 2.03 FRAMING MATERIALS

A. “Hat shaped” Furring channels: 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gage hot-dip galvanized steel galvanized steel conforming to ASTM C 645.

B. Resilient furring channels: Roll-formed, hat-shaped, 1/2 x 2-5/8 inch, 26 gage hot-dip galvanized steel conforming to ASTM C 645, with pre-punched holes, equal to Dietrich Industries, Inc., Pittsburgh PA, Metal Channel “RC1”.

C. Furring channels: ‘Z-shaped’ 1-1/2 inch depth, roll-formed, 25 gage (0.179 inch [0.45 mm] minimum thickness), hot-dip galvanized steel.

D. Studs: ‘C-shaped’ screw studs, hot-dip galvanized steel complying to ASTM C 645, 20 gage-equivalent (nominal 0.02 inches [0.75 mm] factory ribbed and/or embossed

for performance equivalent to 20 gage (0.0329 inch [0.84 mm] minimum thickness studs), of widths indicated on the Drawings.

1. Framing members shall have a G-40 (hot-dipped galvanized) minimum protective coating conforming to ASTM A653 and ASTM A1003 (Table 1), or approved "G40EQ" equivalent coating.
2. Acceptable products include the following or approved equal:
   a. Clarkwestern Dietrich Building Systems, LLC, product "ProStud".
   b. Marino\Ware, Division of Ware Industries, product: "ViperStud Viper30".
   c. Cemco Steel Framing and Metal Lath, product; "ViperStud Viper30".
   d. Super Stud Building Products Inc., product: "Edge EQ, EDS20P".
3. Provide full 20 gage (0.0329 inch [0.84 mm] minimum thickness studs where required under the indicated UL assemblies to meet fire resistance ratings.

E. Runners for metal studs: 'U-shaped' hemmed, hot-dip galvanized steel track conforming to ASTM C645, of gage and width to match respective stud sizes, or heavier gage per design requirements, having 1-1/4 inch leg, provided at tops and bottoms of all studs and at heads of all openings in stud partitions.

F. Internal reinforcement for various stud conditions, and bracing as required: 10 gage, minimum, galvanized steel.

G. Furnish cross bracing and knee bracing, as required to assure a completely rigid assembly on metal stud partitions and furred areas.

## 2.04 CELLULAR PVC SILLS

A. Expanded rigid poly vinyl chloride with a small-cell microstructure, in profiles indicated, and complying with the following:
   1. Density: Minimum of 0.50 g/cc per ASTM D792.
   2. Water absorption: Less than 1 per cent per ASTM D570.
   3. Hardness: At least 50 per ASTM D2240 (Shore D).
   4. Flexural strength: At least 3,300 psi per ASTM D790.
   5. Tensile strength: At least 2,200 psi per ASTM D638.

B. Acceptable manufacturers include the following:
   1. New England Specialty Lumber Inc, W. Springfield MA, product: "Nels-Tek 600".
   2. Vycom Corporation, Moosic PA, product: "Azek".
   3. CertainTeed Corp., Valley Forge, PA, product "Restoration Millwork".
   4. Jen-Weld Corporation, Dubuque, IO., product "Miratec."
   5. Wolfpac Technologies, Inc., Aliquippa, PA, product: "Versatex".
   6. Fypon, LLC., Maumee OH., product "Cellular PVC Trim".

7. PVC Sheets and Trim: “Celtec550” as distributed by New England Lumber Specialties, Inc., West Springfield, MA.

2.05 DEFLECTION TRACK ASSEMBLIES:

A. Non Fire-Rated Assemblies

1. Deflection Track: Manufacturer’s standard top runner with extended flanges designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs, and the following configuration.

   a. Top runner with extended deep flanges that have one of the following: V-shaped offsets that compress, slots 1 inch on center that allow fasteners for stud attachment; 16 gage sliding clip assemblies attached to top track and clipped to stud, or double track systems as required to meet anticipated vertical movement.

2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   a. Clarkwestern Dietrich Building Systems, LLC, product; “Deep Leg Deflection Track System”, “Fast Top Clip”, or “DoubleTrack System”.

   b. Marino\Ware, Division of Ware Industries, product: “Slotted Track”.

   c. Cemco Steel Framing and Metal Lath, product; “Slotted Track CST”.

   d. Telling Industries, product; “ViperTrack Deep Leg Deflection Track”.

   e. Super Stud Building Products Inc., product: “ITTC 450 Top Track Deflection Clip”.

   f. The Steel Network, Inc., product; “VertiTrack VT”, “VertiTrack VTD”, or “VertiClip SLD”.

B. Fire-Rated Assemblies: Head of wall dynamic fire rated joint systems for assemblies in compliance with UL 2079 HW-D. Provide clips or deep leg track system including step bushings complying with ASTM C 645 fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs.

1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   a. Clarkwestern Dietrich Building Systems, LLC, product; “SLP-TRK Slotted Deflection Track”.

   b. Cemco Steel Framing and Metal Lath, product; “FAS Track UL Assemblies”.

   c. The Steel Network, Inc., Durham, NC. product; “VertiClip SLD”.

d. Fire Trak Inc., Watkins, MN, product “Fire Trak”, or “Posi Clips”

C. Coordination: Verify with partition schedule on the Drawings to ensure proper depth of flange offsets at various partitions types.

2.06 CEILING AND SOFFIT SUSPENSION MATERIALS

A. Hanger attachments: Galvanized steel hanger eyes, of size and capacity to safely sustain a live load of at least 150 pounds per hanger attachment.

B. Hangers: Soft temper, pre-stretched galvanized carbon steel wire, conforming with ASTM A641, with a yield stress load of at least three times design load, but not less than 12 gage.

C. Grid system for direct attachment of finish board: Comprised of double web main furring tees, 1 1/2 inches high by 1-3/8 inches flange face by 0.020 inch thick; double web cross tees, 1 1/2 inches high by 15/16 inch flange face by 0.020 inch thick; 0.020 inch thick wall channels, with 1 1/2 inches interior web height; and all splices, clips, and related items. Provide Underwriters Laboratories Label fire-rated assemblies for locations requiring fire-rated ceilings and soffits

1. Chicago Metallic product “system 640 Furring System”.
2. Armstrong Word Industries product “Drywall Furring System”.
3. Donn (USG) Corporation, Chicago IL., product “USG Drywall Furring System” with DGLW tees.

2.07 CEILING AND SOFFIT FRAMING MATERIALS

A. Carrying channels, 2 inches deep, 16 gage cold-rolled channels, galvanized.

B. Support channels: 3/4 inches deep, 16 gage cold-rolled channels, galvanized.

C. Furring Channels: 7/8 inch by 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gage hot-dip galvanized steel galvanized steel conforming to ASTM C 645.

D. Metal Studs used in soffit and ceiling framing: ‘C-shaped’ screw studs, hot-dip galvanized steel complying to ASTM C 645, 25 gage, of widths indicated on the Drawings, or other gages as required under the specified standards to meet fire resistance ratings.

2.08 ACCESSORIES

A. Metal sheet plate blocking and bracing, where indicated: galvanized sheet 0.0312 inch thickness (20 gage).

B. Fasteners:

1. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
2. Concrete stub nails for securing runners to concrete.

3. Nº.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.

C. Reinforcing plates for blocking: 20 gage cold rolled sheet steel, provide minimum 6 inch width, or as otherwise indicated on the drawings.

## PART 3 – EXECUTION

### 3.01 INSTALLATION, QUALITY STANDARDS

A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 206, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.

B. Wherever fire-resistive rated assemblies are indicated on the Drawings, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.

### 3.02 INSTALLATION OF FURRING

A. Install metal furring channel horizontally, with channels spaced not more than 16-inch on centers , and attaching the channels to the masonry or concrete substrates with expansion type fasteners spaced not more than 8 inches on centers. Shim beneath channels as needed to ensure that a uniform receiving plane is maintained throughout.

### 3.03 INSTALLATION OF PARTITION FRAMING, GENERAL

A. Install metal runners at floor and ceiling to structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.

B. Install metal stud framing with open side facing in same direction, engaging floor and ceiling runners.

1. Stud spacing:
   a. Typical: 16 inches on-center.
   b. For cement board substrate to receive tile finishes: 16 inches on-center.
   c. For partitions supporting wall cabinets and other wall mounted equipment: 12 inches on-center.
2. When necessary to splice studs, nest stud with 8 inch overlap and screw studs together with screws on both flanges.
3. Where studs are installed directly to exterior masonry walls, install asphalt felt between stud and wall.

C. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with screw through both flanges of studs and track, top and bottom.

D. Securely anchor studs to jamb and head anchors of steel door and window frames. Over head of frames and openings in partitions, install a horizontal section of runner with a web flange bent at each end, horizontally and secure to strut studs with two screws in each bent web. Provide cripple studs over wall openings.

E. Where horizontal studs are used for wall reinforcing or framing, cut pieces of stud and install horizontally between vertical studs. Cope horizontal studs to fit between flanges of vertical studs. Bend ends of horizontal studs or install clip angles in order to secure by screwing to vertical studs.

F. Furnish and install additional cross bracing and knee bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.

## 3.04 INSTALLATION OF DEFLECTION TRACK

A. Isolate interior metal stud framing and shaft wall framing from building structure to prevent transfer of loading imposed by structural movement due to deflection.

1. Install deflection track top runner in accordance with manufacturer's instructions and as required to attain lateral support and avoid axial loading.
2. Install fire-rated deflection track top runner in accordance with manufacturer's instructions at top of fire-rated, corridor and smoke partitions.

## 3.05 INSTALLATION OF REINFORCING PLATE BLOCKING

A. Install steel reinforcing plates in partitions and furred walls for the support of wall mounted objects as follows:

1. Wherever such reinforcing plates are indicated on the drawings.
2. In locations where wall bumpers are to be installed for the protection of wall surfaces from swinging doors. (See Section 08 71 00 - DOOR HARDWARE).

B. Secure gage sheet metal reinforcing plates to steel studs with 1-1/4", Type "S" bugle head screws.

## 3.06 INSTALLATION - CEILING SUSPENSION SYSTEM

A. Coordinate layout and installation of suspension system components for suspended ceilings with other work supported by, or penetrating work of this section. Re-adjust ceiling suspension system, prior to the installation of the gypsum board and after installation of mechanical and electrical equipment and fixtures by the respective trades.

B. Install all components of concealed grid system in accordance with the manufacturer's instructions, with current ASTM C 636 requirements, with design and installation of suspended grid system safely sustaining a membrane loading of at least 7.9 pounds per square foot.

C. Install hangers not more than 24 inches on centers over locations of main tee members. Install hanger wires to hanger attachment with triple twists. Install additional wires as required to provide support for main tees, at intervals not exceeding four feet, wherever main tees must be interrupted in order to install other work and at all other locations as may be directed by the Engineer.

D. Install main tees parallel to long dimension of the area, at spacing not to exceed 48 inches on-center. Secure with hanger wire as the work progresses. Install cross tees as recommended by the system manufacturer, except spacing shall not exceed 16 inches on-center.

## 3.07 INSTALLATION OF CEILING AND SOFFIT FRAMING

A. Install framing to height indicated, independent of walls, columns, and above ceiling work. Erect after Work above ceiling is complete. Coordinate the location of hangers with other work.

B. Securely anchor hangers to structural members or embed in structural slab. Space hangers to achieve deflection limits indicated.

C. Space main carrying channels at maximum 48 inch centers; not more than 4 inches from wall surfaces. Lap splice securely.

D. Securely fix furring channels or metal studs to hangers to prevent turning or twisting and to transmitted full load to hangers.

1. Place furring channels perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls and rigidly secure. Lap splice securely.
2. Screw fasten metal studs perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls. Lap splice securely.

E. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

## 3.08 TOLERANCES

A. Install partition and ceiling framing and furring with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

END OF SECTION

SECTION 09 29 00

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. Tile backing panels.

B. Related Requirements:

1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
2. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

### 1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.
4. Mold-resistant gypsum board.
5. Cementitious backer units.
6. Interior trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.
9. Acoustical sealant.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

C. Samples for Initial Selection: For each type of trim accessory indicated.

D. Samples for Verification: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

## 1.04 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build 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 C840 requirements or gypsum board manufacturer's written instructions, 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, 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.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

A. 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. Gypsum Wallboard: ASTM C1396/C1396M.

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. American Gypsum.
b. Armstrong Ceiling & Wall Solutions.
c. Georgia-Pacific Gypsum LLC.
d. USG Corporation.

2. Thickness: 1/2 inch.
3. Long Edges: Tapered

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum.
b. Georgia-Pacific Gypsum LLC.
c. Gold Bond Building Products, LLC provided by National Gypsum Company.
d. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

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. American Gypsum.
    b. Georgia-Pacific Gypsum LLC.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company.

2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Gypsum.
    b. Georgia-Pacific Gypsum LLC.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company.
    d. USG Corporation.

2. Core: As indicated.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.04 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Gypsum.
    b. Georgia-Pacific Gypsum LLC.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company.
    d. USG Corporation.

2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

## 2.05 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Certainteed; SAINT-GOBAIN.
b. James Hardie Building Products, Inc.
c. PermaBASE Building Products, LLC provided by National Gypsum Company.
d. USG Corporation.

2. Thickness: 5/8 inch. (MATCH ADJACENT GYPSUM BOARD SO TILE BACKING PANELS AND GYPSUM BOARD ARE FLUSH)
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
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.

## 2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. 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.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.08 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 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 C665, 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.

E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 07 26 00 "Vapor Retarders."

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

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 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

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. 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 C919 and with manufacturer's written instructions 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 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated
2. Type X: As indicated on Drawings & Where required for fire-resistance-rated assembly
3. Ceiling Type: Ceiling surfaces
4. Mold-Resistant Type: In restrooms, locker rooms, janitor closets
5. Type C: Where required for specific fire-resistance-rated assembly indicated

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-shaped 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-shaped 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 with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

## 3.04 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

## 3.05 INSTALLATION OF 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 C840 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 where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use where indicated.

## 3.06 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 C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Where indicated on Drawings.
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 09 90 00 "Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

## 3.07 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

SECTION 09 30 13

CERAMIC TILE

## PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Porcelain mosaic tile for walls.
2. Porcelain tile for floors.
3. Porcelain tile cove base and bullnose trim.
4. Thin-set application methods.
5. Cementitious backer board.
6. Thresholds.
7. Aluminum trim and edge accessories.
8. Porcelain standard shapes: Inside and outside corners, bullnose, cove base and other trim and shapes as required for a complete installation.

1.02 EXAMINATION OF SITE AND DOCUMENTS

A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to ADVERTISEMENT FOR BIDS for time and date.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab substrate.

B. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit substrate.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

D. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.

E. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: access panels, occurring in partitions and walls.

F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal stud framing to receive cementitious backer board installed under this Section.

G. Section 10 28 13 - TOILET ACCESSORIES: Furnishing toilet accessories and installation templates.

H. Division 22 - PLUMBING: Floor drains.

1.04 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ANSI A108.1A - Installation of Ceramic Tile in the Wet Set Method, with Portland Cement Mortar.
2. ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
3. ANSI A108.4 - Installation of Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
4. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
5. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
6. ANSI A108.9 - Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
7. ANSI A108.10 - Installation of Grout in Tilework.
8. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
9. ANSI A118.1 - Dry-Set Portland Cement Mortar.
10. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile Setting and Grouting Epoxy and Water-Cleanable Tile Setting Epoxy Adhesive.
11. ANSI A118.4 - Latex-Portland Cement Mortar.
12. ANSI A118.6 - Ceramic Tile Grouts.
13. ANSI A118.7 – Polymer Modified Cement Grouts
14. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
15. ANSI A118.9 - Cementitious Backer Units.
16. ANSI A118.10 - Waterproofing.
17. ANSI A137.1 - Specifications for Ceramic Tile.
18. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
19. ASTM C 144 - Aggregate for Masonry Mortar.

20. ASTM C 150 - Portland Cement.
21. ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
22. ASTM C 627 - Evaluating Ceramic Floor Tile Installation Systems.
23. ASTM C 920 - Specifications for Elastomeric Joint Sealant.
24. ASTM C 1026 - Measuring Resistance of Ceramic Tile to Freeze Thaw Cycles
25. ASTM C 1027 - Determining Visible Abrasion Resistance of Glazed Ceramic Tile
26. ASTM D 226 - Asphalt Saturate Felt used in Roofing and Waterproofing.
27. ASTM D 2103 – Polyethylene Film
28. ASTM E 119 – Fire Test of Building Construction and Materials.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.

C. Definitions: For purposes of this specification, the following terms are defined:

1. Wet Areas: Rooms/spaces which has plumbing fixtures, sinks, toilets, or floor drains. Wet areas additionally include rooms/spaces which are exposed to weather.
2. Dry Areas: Rooms/spaces which have no plumbing, sinks, toilets, or floor drains.

## 1.05 SEQUENCING

A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

## 1.06 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.

a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.

2. Shop Drawings: 1/4 inch scale elevations and plans of tile patterns.

3. Selection Samples:

a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Engineer.

4. Verification Samples:

a. Mount tile and apply grout on one 12 by 12 inch cement backerboard board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.

b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.

c. Stone threshold, 12 inch long samples in shaped profile.

5. Source Quality Control Submittals:

a. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.

B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT. Clearly label and package extra materials securely to prevent damage.

1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

## 1.07 QUALITY ASSURANCE

A. General: Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.

B. Sole Source: Obtain installation products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

C. Qualifications:

1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

## 1.08 MOCKUP

A. Construct mockup including backer board waterproofing, tile, finish grout, and specified accessories.

## 1.10 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
3. Deliver and store tile setting materials in original, sealed, containers showing manufacturer's identification, year of production, new weight, date of packaging, and location of packaging.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Store and protect containers above floor level, keep dry until ready for use.
3. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy grouts at 70 degrees Fahrenheit (21º C) temperature for 24 hours prior to use.

## 1.11 SITE CONDITIONS

A. Environmental conditions:

1. General: Maintain ambient temperatures between 50 (10º C) and 80 (26º C) degrees Fahrenheit in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
2. Special environmental conditions for epoxy grout materials: Maintain ambient temperatures between 65 degrees Fahrenheit (18º C) and 80 degrees Fahrenheit (27º C) in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
3. When temperature of substrate exceeds 90 (32º C) degrees Fahrenheit, contact manufacturer for instructions.

B. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.

## 1.12 WARRANTY

A. Manufacturer Warranty: The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written five (5) year warrantee against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.

1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCNA setting systems using specified setting and grout materials.
2. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer's instructions and industry standard guidelines.

B. Special Warranty: Provide 2 year, non pro-rated warranty which shall include provisions for cracking, breakage or failure of tile due to defective workmanship
1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand portland cement and site dilution of additives shall not be permitted.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
1. Wall tile:
   a. Dal-Tile Corporation, Dallas TX.
   b. Crossville Ceramics Inc., Crossville, TN
   c. American Olean Tile Company, Lansdale PA.
2. Floor tile:
   a. Dal-Tile Corporation, Dallas TX.
   b. Crossville Ceramics Inc., Crossville, TN
   c. American Olean Tile Company, Lansdale PA.
3. Mortars, adhesives & Grouts:
   a. Custom Building Products, Inc., Seal Beach, CA.
   b. Laticrete International, Inc., Bethany CT
   c. Mapei Corporation, Elk Grove IL.
4. Cementitious tile backer board ("Cement board"):
   a. Custom Building Products, Inc., Seal Beach, CA.
   b. WR Bonseal Inc., Charlotte, NC.
   c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
   d. United States Gypsum Company, Chicago, IL.
5. Edging materials:
   a. Schlüter Systems L.P., Plattsburgh NY.
   b. Custom Building Products, Inc., Seal Beach, CA.

c. Ceramic Tool Company Inc., Waukesha WI.

2.02 WALL TILE

A. Glazed ceramic wall tile at Locker Rooms and Administrative Bathroom: Standard Grade porcelain tile, conforming to ANSI A137.1, nominal 4 ¼ inch by 12 ¾ inch by 5/16 inch thick, porcelain body, cushion-edges.

1. Product: Dal-Tile "Modern Dimensions" or approved equal.

a. Colors selected by Engineer from manufacturer's full cost range, including "made to order" colors. Two (2) colors will be selected as indicated on Drawings.

2.03 FLOOR TILE

A. Porcelain floor tile: Standard Grade glazed porcelain floor tile, conforming to ANSI A137.1, nominal 24 by 12 inch by 5/16 inch thick, cushion-edges.

1. Field Tile: Dal-Tile "Rhetoric" or approved equal.

a. Color selected by Engineer from manufacturer's full range of available colors.

2. Cove Base Trim: Size to match field tile, coved at bottom. Trim shall include bull nosed internal and external corners and exposed edges. Bullnose runners and corners as detailed on Drawings. Color to match floor tile.

2.04 TILE AT KITCHENETTE BACKSPLASHES

A. Standard Grade porcelain tile, conforming to ANSI A137.1, nominal 4 ¼ inch by 12 ¾ inch by 5/16 inch thick, porcelain body, cushion-edges.

1. Product: Dal-Tile "Modern Dimensions" or approved equal.

a. Colors selected by Engineer from manufacturer's full cost range, including "made to order" colors. Color to be selected by architect.

2.05 STONE THRESHOLDS:

A. Where indicated on the Drawings, provide marble thresholds complying with Class "A" of the Marble Institute of America, in color selected by the Engineer from standard colors of the approved fabricator, shaped to provide a comfortable transition between tile and other floor finishes, with smooth matte surface finish and in the dimensions and thickness shown on the Drawings.

2.06 SETTING MATERIALS:

A. Thin-set polymer-modified Portland cement dry-set mortar, complying with the bond strength requirements of ANSI A118.4.

1. Acceptable products include the following or approved equal:

a. Mapei product: "Kerabond" with "Keralastic" additive.

b. Laticrete product number 254 Platinum, with antimicrobial additive.

c. Custom Building Products " Porcelain Tile Mortar"

B. Mortar for porcelain tile: complying the requirements of ANSI A118.4. Acceptable products include the following or approved equal:

1. Mapei product: “Grani-Rapid”.
2. Laticrete product number 254 Platinum, with antimicrobial additive.
3. Custom Building Products “ Porcelain Tile Mortar”

C. Mortar for glass tile: complying the requirements of ANSI A118.4. Acceptable products are limited to:

1. Ardex Americas: Product “Ardex S48.”
2. Mapei product: “Adesilex P10”.
3. Laticrete product “Glass Tile Adhesive Mortar.
4. Custom Building Products “ Glass Tile Premium Thin-Set Mortar”

D. Fluid applied waterproofing membrane: ASTM C627 classification “Extra Heavy”. Two component liquid rubber membrane cold applied, load bearing, bonded, non-toxic, non-flammable, and non-hazardous, used with 20 mil (0.5mm) thick flexible nonwoven rot-proof polyvinyl chloride reinforcing fabric.

1. Waterproofing membrane shall be IAPMO certified as shower pan liner under the International Plumbing Code.
2. Waterproofing membrane shall provide crack suppression and isolation for anti-fracture per ANSI A118.12.5.4, spanning 1/8 inch (3mm) crack, and meet the following physical requirements:
   a. Water Permeability (at 30ft.hydro/0.9 atmos/91.2kPa): Nil.
   b. Elongation at break (ASTM D-751): 20 to 30%
   c. Service Temperatures: -20° to +280°F. (-29°to +138°C).
   d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm″)
   e. Bond strength to concrete: 350psi (2.4MPa;24kg/cm″)
   f. Resistance to chemicals (90 day immersion):
      1) Brine solution Not Affected.
      2) Sugar solution Not Affected.
      3) Milk Not Affected.
      4) 10% Citric Acid Not Affected.
      5) 3.5 percent HCI Acid: Not affected.
      6) 5% Acetic Acid: Not Affected
      7) 1% Alkali solution: Not Affected
      8) Urine: Not Affected
      9) Calcium chloride: Not Affected.
      10) Toluol Softens.
   g. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles

h. Service Rating (TCNA) Extra Heavy Duty

3. Acceptable products include the following, or approved equal:
   a. Mapei product: “Mapelastic 400” with fabric reinforcing
   b. Laticrete product “Laticrete 9235 Waterproofing”.
   c. Custom Building Products “9240 Waterproofing”
   d. Bostik Corp. (Hydroment), product “Black Top 90210”.
   e. TEC Specialty Construction Brands (HB Fuller), product “TEK Triple Flex”.

E. Anti-fracture membrane for crack suppression and substrate crack isolation:
   1. Acceptable products include the following, or approved equal:
      a. Mapei product: “Plani/Lastic”.
      b. Laticrete product “Blue 92”.
      c. Custom Building Products “Crack Buster Pro” or Fracture Free
      d. TEC product 1flex Crack Isolation Membrane.
      e. Bostik Corp. (Hydroment), product “Hydroment Gold”.

F. Cementitious tile backer board (“cement board”): 1/2-inch nominal thickness manufactured for exterior application, glass fiber reinforced, with a minimum compressive strength of 2,500 pounds per square inch and minimum flexural strength of 1,500 pounds per square inch.
   1. Acceptable products include the following, or approved equal:
      a. Custom Building Products, Inc. product “Wonder-board”.
      b. Fin Pan, Inc., product: “Ultil-a-Crete”.
      c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC., product “PermaBase”.
      d. United States Gypsum Company, product: “Durock”.

## 2.07 GROUTING MATERIALS

A. Grout for walls having joints less than 1/8 inch width: Acrylic modified Portland cement (unsanded) grout conforming to ANSI 118.6. Acceptable products are limited to:
   1. Mapei product: “Ker-800” with acrylic latex additive “Plastijoints”,
   2. Laticrete product “Laticrete 1600 Series (unsanded) with admix 1776 antimicrobial.
   3. Custom Building Products PolyBlend unsanded grouts.

B. Grout for floors, and walls having joints 1/8 inch and greater width: Acrylic modified Portland cement sanded grout conforming to ANSI 118.6. Acceptable products are limited to:

1. Mapei product: “Ultracolor” with acrylic latex additive “Plastijoints”,
2. Laticrete product “Laticrete 1500 Series (sanded) with admix 1776 antimicrobial.
3. Custom Building Products PolyBlend sanded grouts.

2.08 ACCESSORIES

A. Edge strips: Schlüter Systems L.P., product series “Schiene-A”, in height as required for tile thickness, fabricated from extruded aluminum with integrated joint spacer.

2.09 SCAFFOLDS AND STAGING

A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
   1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
   2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
   3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.10 HOISTING MACHINERY AND EQUIPMENT

A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
   1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.

B. Beginning of installation means acceptance of substrate and site conditions.

## 3.02 PREPARATION

A. During the operation of work of this Section, protect surrounding in situ materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

B. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.

C. Vacuum clean substrate surfaces.

D. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.

   1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.

E. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

## 3.03 INSTALLATION

A. Installation Standards: 2016 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation and The American National Standard Specifications for the Installation of Ceramic Tile, 2017 edition (ANSI A108-A118-A136.1), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.

B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.

   1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
   2. Back-butter tiles as required to provide coverage indicated.

C. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Engineer. Do not interrupt tile pattern around openings.

D. Tile Layout and installation

   1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
   2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.

3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.

## 3.04 INSTALLATION OF CEMENT BOARD

A. Walls:

1. Wall framing substrate: Do not install cement board directly over protrusions from stud plane such as heavy brackets or fastener heads.
2. Make necessary cutouts. Install cement board horizontally leaving 1/8 to 3/16 space at all joints, including joints with dissimilar materials. Stagger board joints with those of adjacent rows.
3. Fasten cement board with 1-1/4 inch length type S bugle head screw. Fasten boards every 8 inches on center in field and along edges. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.
4. At all joints and corners, fill gap solidly with dry-set or latex-modified, portland cement mortar and imbed 2 inch mesh fiberglass table and smooth material over joint and corner.

## 3.05 INSTALLATION – METAL EDGE TRIM

A. General: Apply materials in strict accordance with the written instructions and recommendations of edge material and setting materials manufacturers.

1. Ensure that top surface of metal edge and transition strips align with surface plane of tile.
2. Locations: Provide metal edge at every flooring transition between tile and other flooring materials.

B. Press perforated anchoring leg of trim into troweled dry set mortar bedding. Trowel additional mortar over perforated anchoring leg of trim to ensure full coverage and support of tile edges.

C. Solidly embed tiles in manner that tiled surface is flush with top of trim profile. Tile may exceed trim height by 1/32 inch [1 mm] to 1/16 inch [1.5 mm], but tile may not be installed lower than height of trim. Maintain a 1/8 inch [3 mm] minimum uniform joint width between edge of tile and metal trim to be filled by grout.

## 3.06 INSTALLATION OF CONTROL JOINTS

A. General: Provide control joints where indicated on the Drawings, and as directed by the Engineer. Where not indicated, provide joints per the following requirements in specific locations approved by Engineer:

1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.

2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
4. At perimeter walls in rooms and spaces larger than 12 feet on one side.
5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.

B. Locations: Verify exact locations of joints with Engineer prior to commencing tile installation.

C. Control joints:
1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
2. Extend control joints full thickness of tile, setting bed and reinforcing.

D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07920 - JOINT SEALANTS.

3.07 WALL TILE INSTALLATION - TCNA NUMBER W244C WITH THIN-SET:

A. General: Install in accordance with ANSI A108.5, TCNA installation method number W244C, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
1. Setting materials: Latex modified Portland cement (ANSI A118.4).
2. Grout materials: Acrylic modified Portland cement (unsanded) grout (ANSI A118.6).

B. Install latex modified Portland cement mortar bed to a thickness recommended by manufacturer.

C. Grouting:
1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.08 FLOORING INSTALLATION – TCNA NUMBER F113 WITH THIN-SET

A. Description: Thin-set tile installation.

B. General: Install in accordance with ANSI A108.5, and TCNA installation method number F113, and as additionally specified herein below. Apply materials in strict

accordance with the written instructions and recommendations of setting materials manufacturer.

1. Setting materials: Latex modified portland cement (ANSI A118.4).
2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).

C. Install latex/portland cement mortar bed over cured anti-fracture membrane to a nominal thickness of 3/32 inch.

D. Install tile ensuring mortar coverage of at least 90 percent on back of tile.

E. Grouting:

1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
2. Grout tile joints in accordance with ANSI A108.10 and as additionally required.

3.09 FLOORING INSTALLATION – TCNA NUMBER F122

A. Description: Thin-set tile installation with reinforced waterproofing membrane.

B. General: Install in accordance with ANSI A108.5, and TCNA installation method number F122, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.

1. Setting materials:
   a. Membrane: Anti-fracture membrane (DIN18156, part 2).
   b. Bonding coat: Latex modified portland cement (ANSI A118.4).
2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).

C. Install liquid applied waterproofing membrane with reinforcing over entire tile substrate area in strict compliance with manufacturer's written instructions.

D. Install latex/portland cement mortar bed over cured anti-fracture membrane to a nominal thickness of 3/32 inch.

E. Grouting:

1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.10 FLOORING INSTALLATION – TCNA NUMBER F125A

A. Description: Thin-set tile installation with anti-fracture membrane.

B. General: Install in accordance with ANSI A108.5, and similar to TCNA installation method number F125A as modified by requirements herein below. Apply materials in

strict accordance with the written instructions and recommendations of setting materials manufacturer.

1. Setting materials:
   a. Membrane: Anti-fracture membrane (DIN18156, part 2).
   b. Bonding coat: Latex modified portland cement (ANSI A118.4).
2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).
3. Traffic bearing sealant at movement joints over cracks isolation in lieu of grout.

C. Install anti-fracture membrane over entire tile substrate area in strict compliance with manufacturer's written instructions.

D. Install latex/portland cement mortar bed over cured anti-fracture membrane to a nominal thickness of 3/32 inch.

E. Grouting:
   1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
   2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.11 INSTALLATION - GROUT

A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.

B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.

C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.

D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.

E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.

F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.

3.12 REPAIR

A. Replace cracked chipped, broken, and otherwise defective tiles.

B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

3.13 CLEANING

A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tilework.

1. Do not use acid or acid cleaners to clean tile.
2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.14 CURING

A. Cover with clean non-staining 40 pound kraft paper. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.15 PROTECTION

A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

END OF SECTION

SECTION 09 51 23

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 01 Specification Sections, apply to this Section.

### 1.02 SUMMARY

A. Section Includes:

1. Acoustical tiles for interior ceilings.
2. Fully concealed, direct-hung, suspension systems.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

### 1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch long Sample of each type.
3. Exposed Moldings and Trim: Set of 6-inch long Samples of each type and color.
4. Seismic Clips: Full size.

## 1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. 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.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Show operation of hinged and sliding components adjacent to acoustical tiles.
8. Minimum Drawing Scale: 1/4 inch = 1 foot

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

F. Manufacturer to certify that materials provided and installed are asbestos-free, as represented by Manufacturer's Material Safety Data Sheets, on Asbestos-Free Materials Certification Form.

## 1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

## 1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, 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 tiles equal to 100 sq ft min for attic stock.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 10 percent of quantity installed.

## 1.08 QUALITY ASSURANCE

A. 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 mockup of typical ceiling area 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.

## 1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site 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.

## 1.010 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations:

1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.
2. Directly Attached Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.03 ACOUSTICAL TILES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide tiles as follows:

1. Type A1 Ceiling Panel:
   a. Basis of Design:
      a) Tiles: USG Halcyon ClimaPlus #97211

b) Grid: USG Donn ZXLA Ceiling Grid, ZXLA24, ZXLA424

b. Panel Size: 24x 24 by 3/4” thick.
c. Panel Edge: Square edge
d. ASTM E-1264, Type XII, Pattern E&G, UL Fire Resistance Labeled, wet formed ceramic and mineral fiber composite panel, non-directional perforated impervious panel, non-combustible, white vinyl-plastic coating
e. Color: As selected from manufacturer's full range
f. Light Reflectance (LR): Not less than 0.90
g. Ceiling Attenuation Class (CAC): Range from 20 min
h. Noise Reduction Coefficient (NRC): Range from .90 min
i. Edge/Joint Detail: Square
j. Thickness: 3/4 inch
k. Modular Size: As indicated on Drawings

2. Type A2 Ceiling Panel (locker, toilet and janitor rooms):
   a. Basis of Design:
      a) Tiles: USG Radar Ceramic Climaplus, 56644
      b) Grid: USG DXLA Ceiling Grid Series
   b. Panel Size: 24x 24 by 5/8” thick.
   c. Panel Edge: Square edge
   d. ASTM E-1264, Type XII, Pattern E&G, UL Fire Resistance Labeled, wet formed ceramic and mineral fiber composite panel, non-directional perforated impervious panel, non-combustible, white vinyl-plastic coating
   e. Color: As selected from manufacturer's full range
   f. Light Reflectance (LR): Not less than 0.82
   g. Ceiling Attenuation Class (CAC): Range from 38 - 40
   h. Noise Reduction Coefficient (NRC): Range from 0.50 to 0.60.
   i. Edge/Joint Detail: Square
   j. Thickness: 5/8 inch
   Modular Size: As indicated on Drawings

D. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

## 2.04 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. USG Corporation.
3. Certainteed Corporation.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C635/C635M.

1. High-Humidity Finish: Provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

C. Direct-Hung, Double-Web, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

1. Structural Classification: Intermediate-duty system.
2. Access: Upward and side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

a. Initial Access Opening: In each module, 24 by 30 inches

## 2.05 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
c. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

2.06 METAL EDGE MOLDINGS AND TRIM:

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. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Finish: Painted to match color of acoustical unit

C. 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 seismic design requirements.

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.07 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

## 2.08 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended in writing by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

B. Staples: 5/16-inch- 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 for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

A. Testing Substrates: Before adhesively bonding tiles to 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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

C. Layout openings for penetrations centered on the penetrating items.

## 3.03 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings according to ASTM C636/C636M, and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

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. 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.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure 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.
5. 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 the structure to which hangers are attached and the 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.
6. 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.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
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 o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

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 ceiling area and where necessary to conceal edges of acoustical tiles.

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 o.c. and not more than 3 inches from ends. 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. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

## 3.04 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Directly Attached Ceilings: Install bottom surface of tiles to a tolerance of 1/8 inch in 12 feet and not exceeding 1/4 inch cumulatively.

C. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

## 3.05 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical tile ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

## 3.06 ADJUSTING

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.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

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SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

1.01 SUMMARY

A. Prepare substrate to receive resilient base.

B. Furnish and install the following:

1. Coved resilient base at resilient flooring.
2. Straight (non-coved) resilient base at carpeted areas.

1.02 RELATED REQUIREMENTS

A. Section 01 52 13 - TEMPORARY FACILITIES Application of protection paper to finished resilient flooring.

B. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate to receive resilient base.

C. Section 09 65 43 - LINOLEUM FLOORING: Linoleum flooring.

D. Section 09 68 13 – TILE CARPETING: Carpet tile and transition strips.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
2. ASTM F 1861 - Standard Specification for Resilient Wall Base
3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
   a. Include certification of data indicating Volatile Organic Compound (VOC) content of all adhesives. Submit MSDS highlighting VOC limits.
2. Selection Samples: Manufacturers' sample chain of colors available for selection by Engineer.
3. Verification Samples: Each type resilient base and color selected, 24 inches long.

B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT. Clearly label and package extra materials securely to prevent damage.

1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal 24 linear feet for each color and type of resilient base installed.

## 1.06 QUALITY ASSURANCE

A. General: Avoid color and pattern differential; provide base from one production run in any single room or contiguous areas.

## 1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Deliver resilient base materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.

B. Storage and Handling Requirements:

1. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

1.08 SITE CONDITIONS

A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.09 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

B. Manufacturer Warranty:

1. Resilient Base: Provide manufacturer's standard one year limited product warranty for resilient base materials.
2. Adhesives: Provide manufacturer's one year limited product warranty for adhesion reliability.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Johnsonite, Middlefield OH.
2. Burke-Mercer Products Company, San Jose CA.
3. Roppe Corporation, Fostoria OH.
4. VPI Corporation, Sheboygan WI.
5. Tarkett, Inc., Parsippany NH.

2.02 DESCRIPTION

A. Regulatory Requirements:

1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of base trim in accordance with ASTM E 84.

2.03 RESILIENT BASE

A. Rubber Base: 4 inches high, ribbed back, 1/8 inch thick, rounded top complying with ASTM F-1861, Type TP, Thermoplastic Rubber (TBR). Colors shall be as selected. Rubber base shall be furnished in continuous lengths, approximately 100 feet long.

1. Provide coved base at resilient flooring.

2. Provide straight (non-coved) base at carpeted and walk-off entrance mat areas.

B. Base accessories: Premolded end stops of same material, size and color as base. Job-form all external and internal corners from base material, pre-molded corner pieces will not be acceptable

2.04 ACCESSORIES

A. Adhesives

1. General: Water resistant, low VOC, acceptable to the resilient flooring manufacturer, for substrate conditions.

a. Cove Base Adhesives: Maximum VOC 50 [gIL less water]

2. Acceptable manufacturers:

a. Advanced Adhesive Technology, Inc, Dalton GA, product: “No. 432 Modified Acrylic Cove Base Adhesive”.

b. DAP Incorporated, Dayton OH, product: ”Cove Base Construction Adhesive”.

c. W.W. Henry Company, Aliquippa PA., product: “Henry 440 Cove Base Adhesive”.

d. Roberts Consolidated Industries, Inc., City of Industry, CA, product: ”Premium Solvent-Free Cove Base Adhesive”.

B. Joint Sealer for between the top of wall base and irregular wall surfaces: Plastic filler as recommended by manufacturer.

C. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 INSTALLATION

A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Install Resilient base: Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework and other permanent fixtures in areas where base is required.

1. Install in lengths as long as practical.
2. Scribe to fit to door frames and other interruptions.
3. Form all external and internal corners in accordance with manufacturer's written instructions. Cope inside corners and fit neatly.
4. Fill voids with plastic filler along the top edge of the resilient wall base on masonry surfaces or other similar irregular substrates.

## 3.03 CLEANING

A. Post-installation Cleaning: As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.

END OF SECTION

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SECTION 09 65 19

RESILIENT TILE FLOORING

## PART 1 - GENERAL

1.01 SUMMARY

A. General: The work of this Section consists of resilient tile flooring where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.

B. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:

1. Grinding down high spots of substrate.
2. Providing Portland cement-based latex underlayment (filler).

C. Furnish and install the following:

1. Solid vinyl, non-PVC tile flooring.
2. Transition strips wherever edges of resilient tile flooring materials abut dissimilar flooring, where no thresholds occur.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for resilient flooring.

B. Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection for the work of this Section 09 65 19.

C. Section 09 05 06 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for flooring work provided under the Construction Manager.

D. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Resilient base provided under the Resilient Flooring Trade Contract.

E. Section 09 65 23 - RUBBER FLOORING: Rubber tile and sheet flooring, rubber stair treads and risers provided under the Resilient Flooring Trade Contract.

F. Section 09 65 43 - LINOLEUM FLOORING: Linoleum tile and sheet flooring provided under the Resilient Flooring Trade Contract.

G. Section 09 68 13 – TILE CARPETING: Carpet tile and transition strips.

## 1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
2. ASTM F-710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
3. ASTM F 970 – Standard Test Method for Static Load Limit.
4. ASTM F-1066 – Vinyl Composition Floor Tile.
5. ASTM F-1700 – Solid Vinyl Floor Tile.
6. FS SS-T-312 - Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.
7. NFPA 99 – Standard for Health Care Facilities
8. NFPA 253 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.

B. Sequencing:

1. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
   a. Furnish manufacturer’s product literature on flooring adhesive, highlight adhesive properties, including VOC’s and maximum moisture pressure limits for substrates.
2. Shop drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section. Drawings shall bear dimensions of actual measurements taken at the project.

a. Identify each flooring type, colors and patterns, indicate layout of tile units and direction of tile patterns.

b. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.

3. Selection samples: Manufacturers' sample chain of colors and patterns available for selection by Engineer.

4. Verification samples:

a. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.

b. Edging: 12 inches long demonstrating profile, thickness, size and color.

5. Certificates:

a. Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.

A. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Operation and Maintenance Data: Furnish cleaning and maintenance data.

2. Bonds and Warranty Documentation:

a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.

1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra flooring materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.

a. Vinyl composition tile: 3 percent of each material in each color, and pattern installed.

b. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.

## 1.06 QUALITY ASSURANCE

A. General: Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1. Provide types of resilient tile and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
2. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.

B. Qualifications:

1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

## 1.07 MOCK-UPS

A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.

B. Provide installed mock-up of flooring, minimum 100 square feet, illustrating color, texture and finish for each flooring type specified herein, and demonstrating the minimum standard for the Work.

C. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.

D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

E. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

## 1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Do not deliver flooring materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
3. Deliver resilient flooring materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets. Store materials in a clean dry, enclosed space off the ground and protected from the weather

2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
3. Protect adhesives from freezing.

1.10 SITE CONDITIONS

A. Temperature and Humidity: Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.11 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Manufacturer Warranty: provide manufacturer's standard wear warranties for all flooring materials installed under this Section.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Solid Vinyl Flooring:
a. Armstrong World Industries, Inc., Flooring Division, Lancaster PA.
b. American Billrite Inc., Amtico Flooring Division (Amitco), Lawrenceville NJ.
c. The Mohawk Group., Kennesaw GA,

2.02 DESCRIPTION

A. Regulatory Requirements:
1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of flooring in accordance with ASTM E 84.
2. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
a. ASTM E 648 (Critical Radiant Flux) of 0.45 watts per sq. cm. or greater, Class 1.
b. ASTM E 662 (Smoke Generation) Maximum Specified Optical Density of 450 or less.

2.03 PVC-FREE FLOORING TILE

A. PVC-Free Flooring Tile: 12 by 12 inch by 1/8 inch thick solid non-PVC tile with solid color extending through thickness of tile; composed of materials with no PVC (poly-vinyl chloride), no plasticizers and no VOC's complying with ASTM F1066 modified for non-vinyl compound Composition 1, Class 2; Colors shall be as selected by the Engineer from manufacturer's full available range:

1. Armstrong World Industries, Inc., product "Migrations BBT", and "Striations BBT"
2. Mannington Floors, product "Cirro".
3. Mohawk, product "StoneWalk".

B. PVC-Free Flooring Tile: 12 by 24 inch by 1/8 inch thick solid non-PVC tile with solid color extending through thickness of tile; composed of materials with no PVC (poly-vinyl chloride), no plasticizers and no VOC's complying with ASTM F1066 modified for non-vinyl compound Composition 1, Class 2; Colors shall be as selected by the Engineer from manufacturer's full available range:

1. Basis of Design: Armstrong World Industries, Inc., product "Striations BBT".

2.04 ACCESSORIES

A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 00 06 –RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.

B. General Requirements for flooring Adhesives: Refer to Section 09 00 06 –RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.

C. Transition and edge strips:

1. General: Homogeneous vinyl, of profiles required for thickness of abutting materials.
2. Edge strips: Tapered or bull nose edge.
3. Colors: Match or contrast with the flooring, as selected by the Engineer from standard colors available, of width shown on the drawings.

D. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

E. Temporary Floor Protection: Flame retardant treated in conformance with NFPA 701. Acceptable Products include the following, or approved equal:

1. Holland Manufacturing, Succasunna NJ., product: "Blue Shield Flame StopR."
2. Pro Tect Associates, Northbrook, IL, product "Traffic Guard."
3. Protection from the Ground Up, Escondido, CA., product "Deck Cover FR."
4. Surface Shields, Orland Park, IL, product "Cover Shield."

**PART 3 - EXECUTION**

## 3.01 EXAMINATION

A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager's or Trade Contract Bidder's failure to familiarize themselves with the Contract Documents or existing 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.

1. Ensure existing substrate is not cushion flooring or perimeter-bonded sheet flooring. Ensure substrate is firmly bonded to underlayment.
2. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test.
3. Beginning of installation means acceptance of existing substrate and project conditions.

B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.

## 3.02 PREPARATION

A. General: Comply with requirements specified under Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.

## 3.03 INSTALLATION - GENERAL

A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.

1. Apply primers as recommended by adhesive manufacturer's written instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Mix tile to ensure that concentration of surface patterns is uniform throughout. Use tile from cartons in same sequence as manufactured and packaged, if so numbered.

D. Maintain reference markers, holes and openings that are in place or have been marked for future cutting; repeat markers on flooring as marked on substrate. Use non-permanent marking devices which may be cleanly washed off when no longer required.

## 3.04 INSTALLATION - FLOOR TILE

A. Lay flooring in a square grid pattern, with joints and seams parallel to building lines. Lay tile flooring in pattern as indicated on the drawings or if not indicated as such, lay with alternating pattern-grain to form a basket weave pattern. Lay tile with joints straight and continuous in both directions and with border tile not less than 1/2 the width of the tile.

B. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.

C. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.

D. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.

E. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.

3.05 INSTALLATION OF ACCESSORIES

A. Resilient edge and transition strips:

1. Install edge strips at all edges of flooring which would otherwise be exposed.
2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.06 CLEANING

A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.

1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.

B. Post-installation Cleaning:

1. As installation progresses, continually remove excess adhesive from floor, and wall surfaces without damage.
   a. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
2. Sweep floors to remove all loose dirt and debris.
3. After flooring manufacturer's recommended waiting period, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.
   a. Vinyl composition tile floors: Wait at least 5 full days following completion

of tile installation before commencing with cleaning.

C. Final Cleaning:

1. General: Perform final cleaning not before 4 days prior to Owner's intended occupancy date.

   a. Wash floors with non-abrasive commercial detergent with floor machine equipped with green or blue pad. Apply manufacturer's recommended stripping solution when floors are badly soiled.

   b. Apply a minimum of two coats of acrylic floor polish to protect flooring until regular maintenance procedures can be started.

   c. After application and curing of floor polish, ensure that polished floors are protected with heavy kraft paper.

## 3.07 PROTECTION

A. General: Protect finished work under provisions Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.

B. Prohibit traffic on finished floor areas until flooring adhesive has fully set.

C. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.

END OF SECTION

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SECTION 09 67 23

RESINOUS FLOORING

## 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. Resinous flooring systems.

B. Related Sections:

1. Section 03 30 00 – Cast-In-Place Concrete for concrete slab on grade conditions

2. Section 03 05 10 – Concrete Moisture Vapor Reduction Admixture for moisture requirements of resinous floor on top of cast-in-place concrete slab.

### 1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

### 1.05 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

B. Material Certificates: For each resinous flooring component, from manufacturer.

C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

## 1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

## 1.07 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch- square floor area selected by Architect.

   a. Include 96-inch length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
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. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

## 1.09 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing according to ASTM D635.

### 2.02 MANUFACTURERS

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

### 2.03 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

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. Duraflex, Inc.
   b. Sherwin-Williams Company, General Polymers.
   c. Tnemec Inc.

B. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range
2. Wearing Surface: Textured for slip resistance
3. Overall System Thickness: 1/4 inch

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.

D. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.

1. Formulation Description: 100 percent solids

a. Provide fiberglass scrim embedded in reinforcing membrane.

E. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

F. Body Coats:

1. Resin: Urethane
2. Formulation Description: 100 percent solids
3. Type: Pigmented
4. Application Method: Troweled or screeded
5. Number of Coats: Two
6. Thickness of Coats: 1/16 inch
7. Aggregates: Manufacturer's standard

G. Grout Coat:

1. Resin: Urethane
2. Formulation Description: 100 percent solids
3. Type: Pigmented
4. Thickness of Coat: 1/16 inch

H. Topcoats: Sealing or finish coats.

1. Resin: Epoxy novolac
2. Formulation Description: Water based
3. Type: Clear
4. Number of Coats: Two
5. Thickness of Coats: 1/16 inch
6. Finish: Matte

I. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 5,000 psi minimum according to ASTM C579.
2. Tensile Strength: 1,000 minimum according to ASTM C307.
3. Flexural Modulus of Elasticity: 1.1 x 10^6 psi minimum according to ASTM C580.
4. Water Absorption: < 1% percent maximum according to ASTM C413.
5. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation according to MIL-D-3134J.
6. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch according to MIL-D-3134J.
7. Hardness: 80-84, Shore D according to ASTM D2240.
8. Critical Radiant Flux: 0.45 W/sq. cm or greater according to NFPA 253.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with NACE No. 6/SSPC-SP13, with a Concrete Surface Profile (CSP) of 3 or greater in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 4.5 lb of water/1000 sq. ft of slab area in 24 hours.
b. Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

## 3.02 INSTALLATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Reinforcing Membrane: Apply reinforcing membrane to entire substrate surface.

D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 8 inches high.

E. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.

1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.

G. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.

H. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

## 3.03 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

B. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

## 3.04 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

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Section 09 68 13

TILE CARPETING

## PART 1 - GENERAL

1.01 SUMMARY

A. General: The work of this Section consists of tile carpeting where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.

B. Furnish and install carpet tile directly adhered over floors, where indicated on the Drawings, including all accessories necessary to complete the work

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: substrate.

B. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds and bases, installing metal thresholds.

C. Section 08 71 00 - DOOR HARDWARE: Furnishing metal thresholds.

D. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Straight resilient bases, where indicated in conjunction with carpeting.

E. Division 26 - ELECTRICAL: Electrical in floor receptacles.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM D 2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.
2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
3. ASTM E 648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
4. NFPA: Publication 253 - Test for Critical Radiant Flux of Floor Covering Systems.
5. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.
6.

## 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.

C. Sequencing:

1. Sequence work to ensure carpeting is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
2. Ensure that installation of flooring and accessories occurs after other finishing operations and interior wet work is complete and fully cured, including painting.

## 1.05 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including carpet, accessories, adhesives, and leveling materials.
2. Manufacturer's installation instructions: Provide manufacturer's application methods or installation instructions for each item furnished hereunder. Indicate special procedures, and perimeter conditions requiring special attention.
3. Manufacturer's sample warranties.
4. Manufacturer's certificate: Provide certificate stating that the carpet, and other related materials to be supplied hereunder meet all requirements specified herein.
   a. Submit certification from the fiber producer verifying use of the branded fiber in the submitted carpet product.
5. Shop drawings: 1/8-inch scale plans of all carpeted areas indicating direction of carpet, location of seams and method of joining seams.
   a. Show location of different patterns or styles of carpet.
6. Selection samples:
   a. Sample swatches containing manufacturer's full color and blend range.
   b. Vinyl edge strip sample illustrating manufacturer's full color range.
7. Verification samples:
   a. 12 inch long samples of edge strip.
   b. After initial selection of carpet and color blends has been made by the Engineer: 18 inches by 27 inches sample of selected carpet for final approval of the Engineer. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.

B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Maintenance Data: Prior to final acceptance of the carpet installation, carpet subcontractor shall deliver to the Engineer 3 printed copies of the carpet manufacturer's detailed maintenance recommendations for the care cleaning and stain-removal, and repair of the types of carpets installed. Include product data and Material Safety Data Sheets (MSDS) for cleaning materials.

C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.

1. Extra Materials: Upon completion of the Work of this Section, Deliver to the Owner extra materials for future repairs and maintenance. Clearly label and package securely to prevent damage.

a. Owner's carpet tile stock: 25 square yards of each color, pattern and type of carpet installed.

1.06 QUALITY ASSURANCE

A. Manufacturer: Mill specializing in manufacturing specified with a minimum of three years documented experience.

B. Applicator: Company specializing in carpet installation of the type specified herein with a minimum of three years documented experience and approved by carpet tile manufacturer.

1.07 MOCK-UPS

A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.

B. Provide mock-up sample of one room to be designated by Engineer, demonstrating the minimum quality of installation for the Work.

C. Locate mock-ups where directed and include all surfaces scheduled to receive a carpeted finish.

D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

E. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.08 ENVIRONMENTAL CONDITIONS

A. Do not install carpet until areas have been fully enclosed and environmental conditions have reached the levels indicated during occupancy.

B. Store materials for 3 days (72 hours) prior to installation in area of installation to achieve temperature and humidity stability. Carpet and adhesive must be stored at a minimum temperature of 68 degrees F.

C. Maintain area of installation at a temperature of at least 68 degrees Fahrenheit, with a

relative humidity of between 15 and 65 percent, for a period of 72 hours before, during, and for 72 hours after installation.

1. Ensure surface temperature of carpet substrate is great than 55 degrees Fahrenheit at commencement of carpet tile installation.

D. Ventilate spaces where work of this Section occurs, during and for a period of 72 hours after completion of curing. Ventilate to dissipate humidity, and to prevent accumulation of fumes, vapors, and gases. Provide temporary fan units and ducting as required to for venting operations

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store all carpeting material under cover in dry, well-ventilated spaces as soon as delivered. Protect carpeting from damage, dirt, stain, moisture, and mildew.

1.10 WARRANTY

A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:

1. Furnish carpet installer's written guarantee covering prompt and proper replacement of any and all carpeting which indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Engineer, said corrective work being performed by the Carpet installer at no cost to the Owner.
2. Furnish carpet manufacturer’s warranty which shall contain the following:
   a. Commencement date for warranty: Date of Project Substantial Completion.
   b. Wear Warranty - Lifetime of Carpet. No more than 10% face yarn loss by weight in normal use.
   c. Static Warranty - Lifetime of Carpet.
   d. Edge Ravel Warranty - Lifetime of Carpet. Guaranteed no edge ravel in normal use (no seam sealers required).
   e. Delamination Warranty - Lifetime of Carpet. Guaranteed no delamination in normal use (no chair pads required).
   f. Tuft Bind Warranty - Lifetime of Carpet. Guaranteed not to zipper, wet or dry.

**PART 2 - PRODUCTS**

2.01 CARPET TILE

A. General requirements: Carpet tiles, shall conform with or pass tests of the following Standards:

1. ASTM D-2859 (Methenamine Reagent Pill Test).
2. ASTM E-648 (Flooring Radiant Panel Test): Class I (Minimum Average CRF of 0.48).
3. NBS Smoke Chamber Test: Maximum average of 450.
4. AATCC-134 (Electrostatic Propensity): Maximum electrostatic generation

below level of human sensitivity.

B. Carpet tile: To establish a standard of quality, design and function desired, specifications have been based on Lees Commercial Carpet, pattern "Second City Modular", product number DW462, modular carpet, size 18 by 18 inches (45.7 cm x 45.7 cm).

1. Construction - Tufted
2. Surface Texture - Level Loop
3. Face Yarn - Antron® Legacy with DuraTech Soil Protection by DuPont
4. Dye System - Yarn dyed
5. Fiber Technology - Duracolor® by LEES Stain Resistant System
6. Backing Material - Thermobond™ Tile

C. Check matching of carpet before installation and ensure there is no visible variation between dye lots.

2.02 ACCESSORIES

A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.

B. Adhesives for carpet tile: NFPA Class A or UBC Class 1 types, as determined by ASTM E-84 Tunnel Test, as recommended by Carpet manufacturer for application and intended use. Acceptable manufacturers include:

1. Advanced Adhesive Technology, Inc, Dalton GA.
2. DAP Incorporated, Dayton OH.
3. W.W. Henry Company, Aliquippa PA.
4. Macklanburg-Duncan Company, Oklahoma City, OK.
5. Roberts Consolidated Industries, Inc., City of Industry, CA.

C. Transition strips, carpet reducers, edgings and accessories: composition nitrile rubber alloy or , in colors as selected by the Engineer.

1. Acceptable manufacturers:
   a. American Billtrite (Canada) Ltd., Sherbrooke, Quebec.
   b. Burke Industries, San Jose, CA.
   c. Roppe Corporation, Fostoria OH.
   d. Freudenberg Building Systems Inc., Lawrence MA.
2. Profiles as indicated, submit shop drawings for all conditions not indicated and obtain Engineer's approval for each transition/reducer.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper

condition to receive the work of this Section.

1. Ensure that newly placed concrete has cured for a minimum period of 30 days and that moisture content of concrete is within range specified by adhesive manufacturer.
2. Verify that surfaces are smooth and flat with a maximum variation of 1/4 inch in 10 feet and are ready to receive work.
3. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected
4. Beginning of installation means acceptance of existing substrate and site conditions.

B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

## 3.02 PREPARATION

A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.

B. Preheat areas to receive carpet to a minimum temperature of 60 degrees F for 72 hours prior to installation, with a relative humidity between 15 and 60 percent. Maintain minimum temperature of 60 degrees F thereafter.

C. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Small pieces of carpet will not be acceptable.

## 3.03 INSTALLATION

A. Install carpet tile in accordance with carpet and adhesive manufacturers' instructions. Immediately notify Engineer of conflicts. Cement carpet directly to the substrate with specified installation adhesive. Trowel adhesive evenly on the substrate. Install the carpet within thirty minutes after spreading adhesive.

B. Lay carpet tile in a square grid pattern, with joints and seams parallel to building lines. Lay joints straight and continuous in both directions and with border carpet tile not less than 1/2 the width of the tile.

1. Install carpet tile using quarter-turn method as recommended by manufacturer.

C. Install specified edging wherever carpeting abuts a dissimilar flooring material, except where wood thresholds, or resilient floor tile trim occurs.

## 3.04 CLEANING

A. Daily clean work areas by disposing of carpet scraps. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of adhesives and other materials installed under this Section.

B. Clean and vacuum carpet surfaces upon completion of the installation.

## 3.05 PROTECTION

A. General: Protect finished work under provisions of Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.

B. Prohibit traffic from carpet areas for 24 hours after installation.

C. Protect carpet against damage during construction. Cover with not less than 6-mil thick polyethylene covering with taped joints during construction period whenever protection is required, so that carpet will be without any indication of deterioration, wear, or damage at time of completion.

D. Maintain protection of carpeting on each floor or area until work is accepted.

END OF SECTION

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SECTION 09 77 23

PLASTIC WALL PANELS

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Decorative wall panels consisting of corrugated polypropylene substrate with smooth finish.
2. Mounting hardware, adhesives, furring, accessories and trims.
3. Silicone sealant for all joints between panels and moldings, and between panel system and abutting materials.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 – UNIT MASONRY: Masonry substrate:

B. Section 09 29 00 – GYPSUM BOARD: Gypsum drywall substrate.

C. Division 26 - ELECTRICAL: Recessed electrical receptacles.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
3. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
4. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
6. All applicable federal, state and municipal codes, laws and regulations regarding wall finishes and smoke generation.

## 1.04 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
2. Certification: Manufacturer's written certification stating that panel system and all related components to be furnished hereunder, meet or exceed the requirements specified under this Section that all fire-resistive requirements for the indicated requirements have been met.
3. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions
4. Verification samples:
   a. Manufacturer's samples of wall panels, including tongue and groove edges and nailing fins.

## 1.05 QUALITY ASSURANCE

A. Installer qualifications: Installer shall have a minimum of 5 years experience with composite wall panel work similar in scope and size to this project.

## 1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer

B. Handling: Protect materials during handling and installation to prevent damage.

C. Storage:

1. Store materials in clean, dry area indoors.
2. Store wall panels flat.

## 1.07 ENVIRONMENTAL CONDITIONS

A. Installing wall panels:

1. Cold Temperatures: When installing wall panels in temperatures below 40 degrees F, Warm to a minimum of 60 degrees F overnight and leave space between panels to allow for expansion in accordance with manufacturer's instructions.
2. Warm Temperatures: When installing wall panels in temperatures above 70 degrees F, warm panels to a minimum of 60 degrees F in accordance with manufacturer's instructions.

B. Cutting panels: Before field cutting wall panels in temperatures below 40 degrees F, warm panels to a minimum of 60 degrees F overnight.

1.08 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels:

1. Wall Panels: Furnish quantity of full size units equal to 3 percent of the amount installed.

1.09 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

B. Manufacturer Warranty:

1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
2. Warranty Period for Wall Panels: 2 years.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Specified Manufacturer for decorative panels: To establish a standard of quality, design and function desired, specifications have been based on Nudo, Springfield, IL, product: "UtiLite Wall Panel".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Nudo, Springfield, IL.
2. Extrutech Plastics, Inc., Manitowoc, WI.
3. Parkland Plastics, Middlebury, IN.

C. Materials:

1. Panels: Tongue and groove, rib reinforced, non-porous, waterproof, 100 percent virgin polyvinyl chloride panels with a smooth finish.
2. Outside surface: Flat.
3. Thickness: 0.040 inch.
4. Width: 16 inches.

5. USDA and CFIA acceptance.
6. Color: White, glossy finish.
7. Size: As indicated on the Drawings.
8. Surface Burning Characteristics, Class A per ASTM E84.
9. Trim: 100 percent virgin polyvinyl chloride in color to match panels.

2.02 ACCESSORIES

A. Blocking: Provide solid 5/4 inch thick PVC blocking for wall-mounted equipment.

B. 1/2 inch PVC furring.

C. Sealant: One part acetoxy silicone rubber sealant, USDA approved as recommended by panel manufacturer.

D. Fasteners as recommended by manufacturer.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Notify the Engineer of conditions that would adversely affect installation or subsequent use.

B. Do not begin preparation or installation until unacceptable conditions are corrected.

3.02 PREPARATION

A. Ensure walls are dry and clean.

3.03 INSTALLATION

A. Prior to installing panels, remove packaging and allow panels to acclimate to room temperature and humidity for at least 48 hours.
   1. Wall substrate must be dry and free from dirt, dust, grease and other contaminants. Walls must be flat and even. Remove high spots and fill low spots with material acceptable to panel manufacturer.
   2. Painted walls must be prepared to adhesive manufacturer specifications for proper adhesion.

B. General:
   1. Inspect panels for any defects. Do not install panels of unacceptable quality.
   2. Field cutting of all wall systems should be accomplished using a circular saw with fine tooth carbide blade.

a. Position panel so that the saw blade enters the finished HPL side first to avoid chipping or damage. Protect decorative laminate face of panel by covering work area, do not remove protective will until after installation.

C. For installation to studs or furring straps, use mechanical fasteners spaced 24 inches on center. Furring straps shall be no less than 18 gauge, 3-1/2 inches wide.

1. Install panels using the following method.

a. Aluminum moldings.

D. Installation Using Aluminum Moldings:

1. Start in the corner. Mark plumb line 48 1/8 inches from corner.
2. Apply adhesive directly to entire back of composite wall panel using correct trowel with 100% adhesive coverage using crosshatch pattern. Apply adhesive to within 1/2 inch of all edges of panel.
3. Slide panel into molding and withdraw 1/16 inch for aluminum moldings to provide appropriate gap. Align with plumb line.
4. Begin in top corner nearest molding with laminate roller, rolling down and out toward the edge without molding.
5. Continue rolling down and out working across panel away from previously installed panel or initial molding. Remove all trapped air.
6. Install one-piece division bar and caps or next molding by sliding onto panel.
7. Repeat process, working in one direction around room.
8. Immediately remove all adhesive residue. To remove, clean with nonabrasive cotton cloth and warm water. If necessary, use a mild nonabrasive detergent. For cleanup with solvent based adhesives, use mineral spirits or acetone to remove residue.

## 3.04 CLEANING

A. Clean panel surfaces in compliance with manufacturer's recommendations.

1. Use a clean, damp, nonabrasive cotton cloth and a mild liquid detergent or household cleaner.
2. Rinse with clean water using a clean, nonabrasive cotton cloth.
3. Dry panels with a soft, clean nonabrasive cotton cloth.
4. Do not use cleaners containing acid, alkali or sodium hypochlorite.

B. Daily clean work areas by sweeping and disposing of debris and scraps.

C. Completely clean all panel surfaces, clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealants and adhesives with solvents which will not damage the surfaces in any way.

D. Upon completion of the work of this Section, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.05 PROTECTION

A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

END OF SECTION

SECTION 09 81 00

ACOUSTICAL INSULATION

## PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section consists of acoustical insulation where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.

B. Furnish and install:

1. Acoustical insulation as scheduled and where indicated.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 – THERMAL INSULATION.

B. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.

C. Section 09 29 00 - GYPSUM BOARD: Installation of wall board over acoustical insulation.

D. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
2. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
3. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation.
4. ASTM C 665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
5. ASTM E 84 - Surface Burning Characteristics of Building Materials.
6. ASTM E 96 - Water Vapor Transmission of Materials.

1.04 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Storage and Handling Requirements:

1. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Acoustical mineral fiber insulation:
   a. Fibrex Insulations Inc., Sarnia, Ontario
   b. Thermafiber Inc., Wabash IN.
   c. Roxul, Inc., Milton, Ontario. (formerly Rock Wool Manufacturing Company).

2.02 MATERIALS

A. Acoustical batt insulation: Mineral wool fiber insulation batts, conforming to ASTM C665 Type 1, and ASTM C553 with a nominal density of 2.5 pounds per cubic foot, nominally 3-1/2 inches thick.

1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
2. Acceptable products include:
   a. Fibrex Insulations Inc. product: “Fibrex Sound Attenuation Fire Batt (SAFB)”
   b. Roxul, Inc., product “Roxul AFB”.
   c. Thermafiber, Inc. product “Thermafiber SAFB”.

2.03 ACCESSORIES

A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Acoustical insulation:

1. Install insulation in accordance with insulation manufacturer's instructions.
2. Install in interior walls, and ceiling spaces where indicated. Trim insulation neatly to fit spaces. Fit insulation tight in spaces. Leave no gaps or voids.

3.02 CLEANING

A. Daily clean work areas by sweeping and disposing of debris and scraps.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

END OF SECTION

SECTION 09 90 00

PAINTING

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers field painting and coating of surfaces, complete. Shop painting of metal items is specified under the applicable item.

B. A schedule listing the various types of surfaces to be painted and the types of paints to be applied is included herein.

C. Unless otherwise indicated, the following items shall not be painted:

1. Labels on equipment, such as Underwriters' Laboratories and Factory Mutual, equipment identification, performance rating, and name or nomenclature plates.

2. Moving parts of operating units, exposed bolt threads, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.

3. Electrical conduit unless mounted on painted or finished surfaces or exposed in a finished room.

4. Concrete floor slabs

5. Plumbing fixtures.

6. Fiberglass and polyethylene storage tanks.

7. Uninsulated PVC piping (to be banded only)

8. Structural steel not exposed to view.

9. Chrome or nickel plating, stainless steel, bronze, brass.

10. Aluminum other than mill finished or factory primed.

11. Factory finished mechanical and electrical equipment, pumps, machinery and similar items which occur in mechanical, storage or equipment rooms or areas.

12. Factory finished materials, specialties, and accessories unless otherwise specified.

13. Ceramic tile, acoustical tile, resilient flooring, and other integrally finished floor, wall and ceiling finishes.

14. Prefinished millwork items.

15. Fire resistant testing and certification labels, code required labels, safety warning labels, performance rating plates, nomenclature plates, identification plates, and similar other labels.

* 16. Factory prefinished architectural components.

* 17. Electrical panels and cabinets factory finish painted.

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* Except for touch-up painting when required

1.02 Related Requirements:

A. Section 04 20 00, UNIT MASONRY

B. Section 05 50 00, METAL FABRICATIONS

C. Section 05 51 13, METAL PAN STAIRS

D. Section 05 52 13, PIPE AND TUBE RAILINGS

E. Section 06 10 00, ROUGH CARPENTRY

F. Section 06 20 13, EXTERIOR FINISH CARPENTRY

G. Section 08 31 13, ACCESS DOORS AND FRAMES

H. Section 09 29 00, GYPSUM BOARD

I. Section 13 42 00, PRE-ENGINEERED METAL BUILDING

J. DIVISION 21, 22, 23, 26

1.03 SYSTEM DESCRIPTION:

A. The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as prime, intermediate, or finish coats.

B. The Contractor shall do a complete painting job throughout the work in accordance with generally approved modern practices for work of high quality. Unless otherwise

specified, all materials and surfaces customarily painted shall be given not less than one shop coat and two field coats or one prime coat and two finish coats, regardless of whether or not the surface to be painted is specifically mentioned.

C. Paints containing lead shall not be used.

D. To ensure a satisfactory painting job it is essential that the paints applied in the shop and in the field be mutually compatible. The Contractor shall determine what shop paints have been used and shall verify that field applied paints are compatible therewith.

E. The colors of finish coatings shall be selected by the Engineer from color chips submitted by the Contractor for review. The color selection shall be in the form of a schedule indicating the colors to be used on the various surfaces. The colors used in the final work shall be in accordance with the color schedule and shall match the selected color chips.

F. All coating systems used for potable water applications shall be previously approved by the National Sanitation Foundation (N.S.F.) in accordance with Standard 61. Evidence of such approval shall be an approval letter from N.S.F. listing the submitted materials.

G. Paints submitted shall meet all Federal and State E.P.A. regulations pertaining to volatile organic compounds (VOC) compliance.

1.04 REFERENCES:

A. The following standards form a part of these specifications, and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

| | | |
|---|---|---|
| ASTM | F1869 | Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride |

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL CONDITIONS, SUBMIT THE FOLLOWING:

A. Provide manufacturer’s literature of proposed paints shall be submitted to the Engineer for review.

B. The painting schedule shall be submitted to the Engineer for review.

C. Three (3) sets of color chips shall be submitted to the Engineer for selection of colors.

1.06 DELIVERY AND STORAGE:

A. Paint shall be delivered to the site in the manufacturer's sealed containers. Each container shall bear the manufacturer's label, listing the brand name, type and color of paint, and

instructions for thinning. Thinning shall be done only in accordance with directions of the manufacturer. Job mixing or job tinting may be done when approved by the Engineer and for preparing sample colors.

B. Painting materials shall be stored and mixed in a single location designated by the Engineer for this purpose. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. He shall carry all necessary water to his mixing room and shall dispose of all waste outside of the building in a suitable receptacle. The Contractor will be held responsible for any damage done due to failure to observe these precautions.

C. The paint storage area shall be kept clean at all times, and any damage thereto or to its surroundings shall be repaired. Any oily rags, waste, etc., shall be removed from the building every night, and every precaution shall be taken to avoid danger of fire.

D. Heat must be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F. at all times.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

A. PAINT SCHEDULE:

Except as otherwise indicated, all paint used shall be of the type listed in the schedule below, by Tnemec Company, Inc., or equivalent paints by Sherwin-Williams Company, International Paints, or other approved paint fully equal to paint manufactured by the above-named companies. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following painting schedule are submitted in writing to the Engineer, along with sufficient data supported by certified tests.

PAINT SCHEDULE

| Key | | Tnemec | Note 1 |
|---|---|---|---|
| AGE | Acryli Gloss Enamel | 1029 Enduratone | 3.5 |
| APE | Acrylic Polyurethane | 73 Endura-Shield Enamel | 3.0 |
| ABF | Cementitious Block Filler | 130 Envirofill | 80-100 s.f./gal |
| CEE | Catalyzed Epoxy | L69F Epoxoline II | 4.0 |
| CEM | Catalyzed Epoxy Mastic | 27 WB Typoxy | Note 3 |

| Key | | Tnemec | Note 1 |
|---|---|---|---|
| CEP | Catalyzed Epoxy Primer | L69F Epoxoline | 3.0 |
| EMC | Epoxy Modified Cement | 218 Mortar-Clad | Fill/Surface |
| EP | Epoxy-Polyamide (thinned 30% #4 thinner) | FC 22 Pota-pox | 25-30 |
| EPW | Water-based Epoxy Primer | 151 Elasto-Grip | 1.0-1.5 |
| HGV | High Gloss Varnish | | Note 2 |
| HSE | High Solids Epoxy (Minimum 69%) | L69 Epoxy | 6.0 |
| MA | Modified Acrylic | 115 Uni-bond | 3.0 |
| MAE | Modified Acrylic Elastomer | 156 Envirocrete | 6.0-8.0 |
| MCU | Moisture Cured Urethane | Series 1 - Omnithane | 2.5-3.0 |
| MPE | Modified Polyamine Epoxy | Series 435 - Permaglaze | 15-20 mils |
| NE | Novolac Epoxy | 282 Tneme-Glaze | 7.5 |
| PEF | Polyamine Epoxy Finish | 280 Tneme-Glaze | 6.0-8.0 |
| PEP | Polyamine Epoxy Primer | 201 Epoxoprime | 6.0-8.0 |
| PVA | PVA Sealer | 151 Elasto Grip | 0.75-1.5 |
| PWC | Potable Water Coating | Series FC 22 Pota Pox | 25-30 |
| SA | Silicone Aluminum | 39-1261 (Note 4) | 1.5 |
| VB | Vapor Barrier | 262 Elasto Shield | 50-100 |
| WP | Wood Primer | 151 Elasto-Grip | 1.0-1.5 |
| Z | Zinc-Rich Primer | 90G-1K97 Tneme-Zinc | 2.5 |

Notes

1: Minimum Dry Film Thickness/Coat (mils)
2: Furnished by reputable manufacturer and acceptable to the Engineer.
3: Shall be used as a tie-coat between incompatible paints @ 3.0-4.0 mils.
4: This paint is suitable for temperatures up to 1200ºF and must be final cured at 400ºF for one hour.
5:

B. PAINTING SCHEDULE:

Paint shall be applied in accordance with the paint key listed on the following schedule and defined in the preceding Paint Schedule:

| Item | | Field Coats 1st | 2nd | 3rd |
|---|---|---|---|---|
| Walls: | | | | |
| Interior concrete masonry units | | ABF | HSE | HSE |
| Interior concrete designated to be painted, to include top and outside of all concrete curbs | | HSE | HSE | -- |
| Plaster & gypsum wallboard | | PVA | HSE | HSE |
| Floors: | | | | |
| Concrete floors designated to be painted | | PEP | PEF | PEF |
| Ceilings and Walls: | | | | |
| Exposed galvanized metal deck/bar joists, dry spaces^ | | MA | -- | -- |
| Plaster & gypsum wallboard | | PVA | CEE | CEE |
| Equipment Items: | | | | |
| With shop prime coat, including machinery and pumps (non-submerged) | Interior | *CEP | CEE | -- |
| | Exterior | *CEP | APE | |
| (submerged) | Exterior | MPE | MPE | |
| With shop finish coat (when designated to be painted) | Interior | *CEM | CEE | -- |
| | Exterior | *CEM | APE | |
| Metals: | | | | |
| Exposed interior structural steel including monorails and supports | | *Z | CEE | CEE |
| Exposed exterior structural steel including monorails and supports | | *Z | CEE | APE |
| Interior miscellaneous galvanized and non-ferrous metals and piping | | CEE | CEE | -- |
| Exterior miscellaneous galvanized and non ferrous metals and piping (SP7 required) | | CEE | APE | -- |
| Miscellaneous interior ferrous piping, metalwork, ferrous parts or operating devices, valve handles, levers, pumps, and ferrous hangers and supports (exterior exposure) | | CEP | CEE | -- |
| | | CEP | CEE | APE |
| Exposed electrical conduit, conduit fittings, outlet boxes | | Same as adjacent wall or ceiling | | |
| Hot ferrous metal surface | | SA | SA | -- |

| | | | |
|---|---|---|---|
| Doors and Frames: | | | |
| Interior hollow metal doors, frames and panels | AGE | AGE | -- |
| Exterior hollow metal doors | AGE | AGE | -- |
| Piping: | | | |
| PVC Piping designated to be painted (SP7 or hand sand) | CEE | CEE | -- |
| Pipe insulation (plastic or metal sheathed paint as scheduled for plastic or metal surface) | PVA | CEE | CEE |
| Other piping (see metals) | | | |

* Spot Prime

***For existing, painted masonry walls, use EPW primer, followed by two coats of MAE.

^ If galvanized metal is provided with a light top coat sealer, light brush blast surface preparation is required prior to first field coat

B. SPARE PAINT:

1. Furnish to the Owner one unopened gallon of each type and color of paint used on the work.

2. Furnish both components for each type and color of epoxy paints used on the work.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Before any surface is painted, it shall be cleaned carefully of all dust, dirt, grease, loose rust, mill scale, old weathered paint, efflorescence, etc. All necessary special preparatory treatment shall then be applied. Where required, imperfections and holes in surfaces to be painted shall be filled in an approved manner.

B. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surfaces which have been cleaned, pretreated, or otherwise prepared for painting, shall be painted with the first field coat as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surface.

D. Wood shall be sanded to a smooth and even surface and then dusted off. Before priming wood that is to be painted, shellac shall be applied to all knots, pitch and sapwood. After priming or stain coat has been applied, nail holes and cracks shall be thoroughly filled with plastic wood or putty. For natural finish work, putty shall be colored to be imperceptible in the finished work.

E. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paint shall be spot primed with aluminum.

F. Cracks and holes in masonry and concrete surfaces to be painted shall be filled with patching material recommended by the coatings manufacturer. Surfaces shall be clean and dry before painting. All efflorescence, grease, oil, etc., shall be removed before painting, and all loose, crumbling material shall be removed by vigorous wire brushing over entire surface, followed by removal of all dust. All high areas on masonry and concrete surfaces such as mortar daubs, mortar ridges at joints, and ridges at form joints in concrete shall be removed.

G. All holes in plaster shall be filled with plaster of paris and all cracks shall be cut out and filled. No sandpaper shall be used on plastered surfaces. Prior to painting, surfaces shall be tested with a moisture detecting device, such as Kaydel Plaster Tester, Type CP-48, as manufactured by Hard Moisture Gauges, Inc. No sealer or paint shall be applied when the moisture content of the plaster exceeds 8 percent, as determined by the test. Testing shall be done in the presence of the Engineer's representative, and in as many locations as directed. Plaster shall be thoroughly dry-brushed before painting or sealing.

H. All nonferrous metal surfaces to be painted shall be cleaned of all dirt, grease, oil and other foreign substances uniformly profiled per SSPC SP 7.

I. All galvanized surfaces to be painted shall be brush blasted to create a uniform surface profile per SSPC SP7.

J. Before application of the first full field coat, abraded areas of all non-galvanized ferrous metal items having shop coats shall be touched up with paint of the type indicated on the Painting Schedule.

K. All items of equipment such as motors, pumps, instrumentation panels, electrical switchgear, and similar items, that have been given shop coats, paint filler, enamel or other treatment customary with the manufacturer, shall have, after installation, all scratches and blemishes touch up prior to application of the first field coat. Factory prefinished items not to be field painted shall be touched up with matching paint to repair any areas damaged during installation.

L. All submerged concrete surfaces that are to receive an epoxy coating shall be brush blasted to remove surface laitance and provide a uniform surface profile, reference SSPC SP #13. Surface preparation may commence one week after the concrete has been pronounced cured. The curing period is defined as that length of time during which the concrete is fully hydrated (28-day cure). Patch holes and voids with specified modified epoxy cement prior to coating.

M. Concrete floors that are to receive epoxy coating shall be brush blasted or shot blasted per SSPC SP #13 and ICRI Surface Profile requirements per the coating manufacturer (Blastrack). Check for excessive moisture migration per ASTM F1869, Moisture Vapor

Emission Rate Using Anhydrous Calcium Chloride. Test results not to exceed 3 lbs per 1,000 square feet in one 24-hour period.

N. Hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place prior to cleaning and painting, and not intended to be painted, shall be removed during painting operations and repositioned upon completion of each area or shall otherwise be protected.

O. All PVC pipe to be painted shall be brush blasted per SSPC SP7 or shall be sanded to provide a uniform surface profile.

3.02 APPLICATION:

A. Paint shall be used and applied as recommended by the manufacturer without being extended or modified, and with particular attention to the correct preparation and condition of surfaces to be painted.

B. Paint shall be applied only within the temperature range recommended by the manufacturer. Painting of surfaces when they are exposed to the sun shall be avoided.

C. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog, or mist, or when the relative humidity exceeds 85 percent.

D. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40ºF within 18 hours after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. Further, the days painting should be completed well in advance of the probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to the formation of moisture.

E. All paint shall be applied under favorable conditions by skilled painters and shall be brushed out carefully to a smooth, even coating without run or sags. Enamel shall be applied evenly and smoothly. Each coat of paint shall be allowed to dry thoroughly, not only on the surface but also throughout the thickness of the paint film before the next coat is applied. Finish surfaces shall be uniform in finish and color, and free from flash spots and brush marks. In all cases, the paint film produced shall be satisfactory in all respects to the Engineer.

F. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paints shall be spot primed with aluminum paints.

G. In order to provide contrast between successive coats, each coat shall be of such tint as will distinguish it from preceding coats.

H. The Contractor shall not only protect his work at all times but shall also protect all

adjacent work and materials by the use of sufficient drop cloths during the progress of his work. Upon completion of the work, he shall clean up all paint, spots, oil, and stains from floors, glass, hardware, and similar finished items.

I. Paint shall be applied so as to obtain coverage per gallon and the dry film thickness recommended by the manufacturer. Dry film thickness readings shall be taken to insure that required thicknesses have been achieved. The Contractor shall record in a manner satisfactory to the Engineer, the quantities of paint used for successive coats on the various parts of the work.

J. Spraying with adequate apparatus may be substituted for brush application of those paints and in those locations for which spraying is suitable.

K. If paints are thinned for spraying, the film thickness after application shall be the same as though the unthinned paint were applied by brush. That is, the addition of a thinner shall not be used as a means of extending the coverage of the paint, but the area covered shall be no greater than the area that would have been covered with the same quantity of unthinned paint.

L. Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.

M. The use of carbon dioxide or carbon monoxide emitting heaters is not permitted during the painting operation. Only indirect hot-air systems shall be permitted.

3.03 PIPING COLOR CODE:

The following Tnemec colors shall be utilized to facilitate identification of piping. Only insulation is to be painted on chemical feed lines.

1. Water Lines

| | | |
|---|---|---|
| Finished or Potable | Dark Blue | 11SF |

2. Wastewater or Potable Waste Lines

| | | |
|---|---|---|
| Sewer (sanitary or drain) | Dark Gray | 34GR |

3. Other

| | | |
|---|---|---|
| Compressed Air | Dark Green | 91GN |
| Gas or Oil | Red | 28RD |
| Other Lines | Light Gray | 32GR |

B. In situations where two colors do not have sufficient contrast to easily differentiate between them, a 6-inch band of contrasting color shall be painted on one of the pipes at approximately 30-inch intervals.

C. Piping which is not painted shall be color coded with bands placed at each change in direction and no more than 5 feet apart on straight runs.

3.04 PIPING IDENTIFICATION:

A. After painting, piping shall be identified by stenciling using the same specified paint as used on the pipes. Stenciling shall be of wording and color selected by the Engineer and sized as follows:

| Outside Diameter of Pipe or Covering | Size of Legend Letters |
|---|---|
| 3/4-inch to 1-1/4-inch | 2-inch |
| 1-1/2-inch to 2-inch | 3/4-inch |
| 2-1/2-inch to 6-inch | 1-1/4-inch |
| 8-inch to 10-inch | 2-1/2-inch |
| Over 10-inch | 3-1/2-inch |

B. Arrows shall indicate direction of flows. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6-inches.

C. Where pipe passes through a wall, use pipe markers and directional arrows on each side of the wall.

D. Use pipe markers and directional arrows every 50 feet along continuous pipe lines.

E. Use a pipe marker and directional arrow at each rise and "T" joint.

F. When using directional arrows, point arrowhead away from pipe markers and in direction of flow. If flow can be in both directions, use a double-headed directional arrow.

G. The Engineer will assist in determining pipe content and direction of flows.

3.05 CLEANUP:

A. The Contractor shall at all times keep the premises free from accumulation of waste material and rubbish caused by his employees or work. At the completion of the painting, he shall remove all of his tools, scaffolding, surplus materials, and all of his rubbish from and about the buildings and shall leave his work "broom clean" unless more exactly specified.

B. The Contractor shall also, upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, glass, hardware, etc., leaving the work ready for inspection.

END OF SECTION

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DOCUMENT 09 91 13

EXTERIOR PAINTING SCHEDULE

## PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. General: Number of coats scheduled herein below is minimum required, refer to Article entitled “APPLICATION” in specification Section 09 91 00 - PAINTING, regarding coverage.

1.02 PAINTING SCHEDULE FOR EXTERIOR SURFACES AND MATERIALS

A. Exterior METAL, FERROUS, new, shop primed:

1. One coat rust inhibitive primer. (touch up bare metal at existing and shop primed surfaces).
   a. California: “Everlife Oil-based Metal Primer, Nº. 21150.
   b. Devoe Coatings: Devguard 4160 Multi-Purpose Tank & Structural Primer.
   c. Moore: “Universal Metal Primer” Nº. P07.
   d. Pittsburgh: “Speedhide Industrial Rust Inhibitive Primers”, 7-852 Series.
   e. Sherwin-Williams: "Kem Bond HS Universal Metal Primer”.
2. Two coats acrylic gloss enamel:
   a. California: “Everlife 100% Acrylic Waterborne High Gloss “, Nº. 521..
   b. Devoe Coatings: Devflex 4208QD Waterborne Gloss Enamel.
   c. Moore: “Acrylic Gloss Enamel”, Nº. P28
   d. Pittsburgh: “Pitt-Tech DTM Exterior Waterborne High Gloss Enamel”, 90-300 Series.
   e. Sherwin-Williams: " High Performance Acrylic B66-600 Series”.

B. Exterior METAL, GALVANIZED:

1. Wash primer apply if recommended by individual paint manufacturer.
2. One coat primer.
   a. California: “Rust-Stop DTM 100% Acrylic Latex Semi-Gloss”.
   b. Devoe Coatings: Devflex 4020PF Direct To Metal Primer and Flat Finish.
   c. Moore: “DTM. Acrylic Gloss Enamel”, WM28
   d. Pittsburgh: “Pitt-Tech Int/Ext Industrial DTM Primer/Finish Enamel”, 90-712 Series.
   e. Sherwin-Williams: "Pro-Cryl Universal Acrylic Primer”.
3. Two coats of gloss finish direct-to-metal acrylic enamel paint.
   a. California: “Rust-Stop DTM 100% Acrylic Latex Semi-Gloss”.
   b. Devoe Coatings: Devflex 659 Gloss DTM Waterborne Acrylic Enamel.
   c. Moore: “DTM Acrylic Gloss Enamel”, WM28

d. Pittsburgh: “Pitt-Tech Int/Ext Industrial DTM Primer/Finish Enamel”, 90-374 Series.

e. Sherwin-Williams: "High Performance Acrylic B66-600 Series”.

END OF DOCUMENT

DOCUMENT 09 91 23

INTERIOR PAINTING SCHEDULE

## PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. General: Number of coats scheduled herein below is minimum required, refer to Article entitled "APPLICATION" in specification Section 09 91 00 - PAINTING, regarding coverage.

1.02 PAINTING SCHEDULE FOR INTERIOR SURFACES AND MATERIALS

A. Interior CONCRETE AND CONCRETE MASONRY walls and partitions:

1. One coat block filler:
   a. Sherwin-Williams: "Heavy Duty Block Filler", acrylic block filler.
   b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings (dry areas): "Bloxfil 4000 Heavy Duty Acrylic Block Filler".
   c. PPG: "Pitt-Glaze Interior Exterior Block Filler No. 16-90".
2. Two coats acrylic semi-gloss paint:
   a. Sherwin-Williams: "High Performance Acrylic B66-650 Series".
   b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings: "Devflex 4216 HP".
   c. PPG: "Diamond 450 No VOC, No. 7400".

B. Interior CONCRETE MASONRY walls and partitions (Truck Parking Bays):

1. One coat block filler:
   a. Sherwin-Williams: "Heavy Duty Block Filler", acrylic block filler.
   b. Devoe Coatings (dry areas): "Bloxfil 4000 Heavy Duty Acrylic Block Filler".
   c. PPG: "Pitt-Glaze Interior Exterior Block Filler No. 16-90".
2. Two coats epoxy paint:
   a. Sherwin-Williams: "Water Based Catalyzed Epoxy B73-300 Series".
   b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings: "Intergard 1735 Water Borne Epoxy".
   c. Rustoleum: "S60 Water Based Epoxy Maintenance Coating Series 248273".

C. Interior CONCRETE MASONRY walls and partitions:

1. One coat block filler:
   a. Sherwin-Williams: "B42W400 Kem Cati-Coat Epoxy Filler/Sealer, Polymidoamine Epoxy Block Filler".
   b. PPG: "Ameron Armerlok 400BF Epoxy Masonry Block Filler"

c. Pratt and Lambert: “Techgard High Solids Epoxy Block Filler No. S4250”.

2. Two coats high-build epoxy paint:
   a. Sherwin-Williams: “GP3552W Epo-Flex Flexible Wall Epoxy Polyamine Epoxy Membrane”.
   b. Approved equal.
3. One top coat of aliphatic polyurethane:
   a. Sherwin Williams: “GP4685W Poly-Cote Urethane”.
   b. Approved equal.

D. Interior EXPOSED DUCTWORK, Insulated and Wrapped
1. Apply one prime coat and two finish coats of a paint recommended by the approved paint manufacturer for application on the exposed wrapping material.

E. Interior GYPSUM BOARD (drywall) partitions:
1. One coat latex primer.
   a. California: “Elements 100% Acrylic White Primer”, Nº. 74600.
   b. Glidden Professional: Lifemaster No VOC Primer Nº. 9116.
   c. Moore: “Eco Spec Interior Latex Primer Sealer”, Nº. 231.
   d. Pittsburgh: “Pure Performance Interior Latex Primer”, Nº. 9-900.
   e. Sherwin-Williams: "Harmony Interior Latex Primer”, B11W900 Series.
2. Two coats eggshell paint:
   a. California: “Elements 100% Acrylic Zero VOC Eggshell”, Nº. 731.
   b. Glidden Professional: Lifemaster No VOC Eggshell Nº. 9300.
   c. Moore: “Eco Spec Interior Latex Eggshell”, Nº. 223.
   d. Pittsburgh: “Pure Performance Eggshell”, Nº. 9-300.
   e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel, B9 Series”.

F. Interior GYPSUM BOARD (drywall) partitions, at toilet rooms, janitor’s closets, for VOC compliant epoxy finish:
1. One coat of sealer,
   a. California: “Prime Choice ASAP Primer”, Nº. 50300.
   b. Glidden Professional: Gripper Primer Nº. 3210.
   c. Moore: “SuperSpec Primer”, Nº. 253.
   d. Pittsburgh: “Speedhide Interior Quick Drying Latex Sealer”, 6-2 Series.
   e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28w2600 Series.
   f. Tnemec: PVA 51-792 Sealer.
2. Two coats of semi-gloss Water Based Acrylic-Epoxy Coatings (3 mils DFT each coat).

a. California: No equivalent.

b. Devoe Coatings: Tru-Glaze-WB" 4418 Waterborne Acrylic Epoxy Coating.

c. Moore: "Industrial Acrylic Epoxy Enamel", Nºs. P43/P44.

d. Pittsburgh: "Pitt-Glaze Water Based Acrylic Epoxy Enamels", 16 Series.

e. Sherwin-Williams: "Water Based Catalyzed Epoxy B73-300 Series".

f. Tnemec: "Tneme-Tufcoat", Nº. 112.

G. Interior METAL, FERROUS, (Wet Environment):

1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:

a. Sherwin-Williams: "Corothane I Galvapac 1K or 2K Zinc Primer", organic zinc rich moisture cured urethane, or Sherwin-Williams: "Macropoxy HS", (shop primer retained).

b. Moore: "V170 Organic Zinc Rich Primer".

c. Approved equal.

2. One brush stripe coat of epoxy:

a. Sherwin-Williams: "Macropoxy 646 FF", (brush stripe first top coat).

b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings: "Intercure No. 384, Series 384".

c. PPG: "Ameron Amerlock 2/400 GFK High Gloss Glass Flake Epoxy No. 2/400 GFK".

3. One full coat of epoxy (8.0-10.0 DFT):

a. Sherwin-Williams: "Macropoxy 646 FF", (brush stripe first top coat).

b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings: "Intercure No. 384, Series 384".

c. PPG: "Ameron Amerlock 2/400 GFK High Gloss Glass Flake Epoxy No. 2/400 GFK".

H. Interior METAL, FERROUS, (Shop Primed):

1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:

a. Sherwin-Williams: "No. B66W00310 Pro-Cryl Universal Primer".

b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings: "Devguard 4160 Multipurpose Structural Primer".

c. PPG: "Amercoat 148 Waterborne Acrylic Primer Series 148".

2. Two coats water based epoxy:

a. Sherwin-Williams: "Water Based Catalyzed Epoxy B73-300 Series".

b. Akzo Nobel Paints, LLC, Devoe High Performance Coatings: "Intergard 1735 Water Borne Epoxy".

c. Rustoleum: “S60 Water Based Epoxy Maintenance Coating Series 248273”.

I. Interior METAL, FERROUS, excluding railings, to receive semi-gloss finish: (includes galvanized metal doors and frames):

1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:
   a. California: “Rust-Stop DTM Primer/Finish”, Nº. 1061.
   b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
   c. Moore: “Acrylic Metal Primer”, Nº. P04.
   d. Pittsburgh: “Pitt-Tech DTM Primer/Finish 100% Acrylic”, 90-709/712 Series
   e. Sherwin-Williams: "Pro-Cryl Universal Acrylic Primer”.
2. Two coats acrylic semi-gloss enamel:
   a. California: “Rust-Stop DTM Primer/Finish”, Nº. 1061.
   b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
   c. Moore: “Super Spec HP DTM Semi-Gloss Enamel”, Nº. P29.
   d. Pittsburgh: “Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel”, 90-1210 Series.
   e. Sherwin-Williams: “Sher-Cryl HPA Semi-Gloss”, B66 Series.

J. Interior METAL, GALVANIZED, (includes exposed ductwork):

1. Touch-up with metal primer.
   a. California: “Rust-Stop DTM Primer/Finish”, Nº. 1061.
   b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
   c. Moore: “Acrylic Metal Primer”, Nº. P04.
   d. Pittsburgh: “Pitt-Tech DTM Primer/Finish 100% Acrylic”, 90-709/712 Series.
   e. Sherwin-Williams: "Pro-Cryl Universal Acrylic Primer”.
2. Two coats acrylic semi-gloss enamel:
   a. California: “Rust-Stop DTM Primer/Finish”, Nº. 1061.
   b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
   c. Moore: “Super Spec HP DTM Semi-Gloss Enamel”, Nº. P29.
   d. Pittsburgh: “Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel”, 90-1210 Series.
   e. Sherwin-Williams: “Sher-Cryl HPA Semi-Gloss”, B66 Series.

K. Interior METAL, RAILINGS, (handrails and guardrails) to receive aliphatic acrylic polyurethane finish:

1. First coat, epoxy undercoat:

a. International: “Interseal 670 HS” at 5.0 mils DFT.

b. Tnemec: “69 Color High-Build Epoxoline II” at 3.0 mils DFT.

c. Devoe Coatings: Tru-Glaze-WB” 4030 Waterborne Epoxy Primer

d. Moore: “Superspec HP Epoxy Metal Primer”, P33 Series.

e. Pittsburgh: “PPG All Weather DTR” 97 Series @ 5 mils DFT, 18 Month Recoat

f. Sherwin-Williams: “Macropoxy 646 Fast Cure Epoxy B58-600 Series” @ 4.0 – 6.0 mils DFT.

2. Second coat, high gloss aliphatic acrylic polyurethane coating:

a. International: “Interthane 990” at 4.0 mils DFT.

b. Tnemec: “74 Endura Shield” at 4.0 mils DFT.

c. Glidden Professional: Devthane 359H DTM High Build Gloss Enamel @ 4.0-6.0 mils DFT.

d. Moore: “Superspec HP Aliphatic Urethane”, P74 Series.

e. Pittsburgh: “Pitt-Thane Ultra” 95-800 Series @ 4 mils DFT.

f. Sherwin-Williams: “Hi-Solids Polyurethane” @ 3.0 – 5.0 mils DFT.

## 1.03 PAINTING SCHEDULE FOR FIRE RESISTIVE AND RATED DESIGNATIONS

A. In compliance with *International Building Code*, 2006 edition, as published by the International Code Council, Inc. (I.C.C.), as amended and incorporated under Title 19 NYCCR part 1221 - *Building Code of New York State* (BCNYS), 2010 edition and as additionally specified herein, provide identification for all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions and any other wall or partition which is required to have protected openings or penetrations.

1. Application:

a. Apply to outside of fire rated shafts, and to both sides of partitions at intervals not to exceed 30’-0” for entire length of partition or wall, or once on any partition 30’-0 feet or less in length.

b. Locate identification in all accessible concealed floor, floor-ceiling and attic spaces. Locate identification within 12 to 18 inches above finished ceilings.

c. Apply stenciled lettering by spray or brush, or provide permanent signage. Identification shall be waterproof, fade-proof and non-combustible. Signage shall be mechanically fastened or permanently adhered to partition.

d. Stencil character height: 1 inch minimum.

e. Color: Easily identifiable color, contrasting with background, acceptable to Owner.

2. Apply stenciled lettering to the following types of partitions using wording specified:

a. Applied identification for 4 hour fire rated partitions shall read: “4 HOUR FIRE WALL – PROTECT ALL OPENINGS”

b. Applied identification for 3 hour fire rated partitions shall read: “3 HOUR FIRE WALL - PROTECT ALL OPENINGS”.

c. Applied identification for 2 hour fire rated partitions shall read: “2 HOUR FIRE WALL - PROTECT ALL OPENINGS”.

d. Applied identification for 1 hour fire rated partitions shall read: “1 HOUR FIRE WALL - PROTECT ALL OPENINGS”.

e. Applied identification for Smoke barriers shall read: “1 HOUR SMOKE BARRIER - PROTECT ALL OPENINGS”.

f. Applied identification for Smoke partitions shall read: “SMOKE BARRIER PARTITION - PROTECT ALL OPENINGS”.

1.04 PAINTING SCHEDULE FOR MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black enamel.

B. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

C. Remove unfinished louvers, grilles, covers and access panels on and paint as scheduled above.

D. Plywood backboards for electrical panels and other equipment. Paint both front and back surfaces and all edges of plywood backboards before backboards are installed.

1. One coat latex primer-sealer (undercoater):

a. Glidden Professional: Lifemaster No VOC Primer Nº. 9116.

b. Moore: “EcoSpec Interior Latex Primer Sealer” 231.

c. Pittsburgh: “Pure Performance Interior Latex Primer”.

d. Sherwin-Williams: "Harmony Interior Latex Primer” B11W900.

2. Two coats latex semi-gloss paint:

a. Glidden Professional: Lifemaster No VOC Semi-Gloss” Nº. 9200.

b. Moore: “EcoSpec Interior Latex Semi-gloss” Nº. 224.

c. Pittsburgh: “Pure Performance Interior Semi-gloss”, 9-500 Series.

d. Sherwin-Williams: "Harmony Interior Latex Semi-gloss" B10 Series.

E. Interior WATER PIPING SYSTEM ‘non potable’, ‘potable water’), Non-insulated, Insulated and Wrapped piping to receive field painted semi-gloss finish, including concealed locations.

1. General Comply with *International Plumbing Code,* 2006 Edition, as published by the International Code Council, Inc. (I.C.C.). as amended and incorporated under Title 19 NYCCR part 1222 – *Plumbing Code of New York State*, 2010 edition and specification requirements of Division 23 – PLUMBING.

2. Sequencing: all recycled water piping must be painted prior to being concealed by work of other trades.

3. Paint types:

a. At non insulated conditions: Same as specified for ferrous metal.

b. At insulated conditions: Apply one prime coat and two finish coats of a paint recommended by the approved paint manufacturer for application on the exposed wrapping material.

4. Colors and patterns:

a. Potable water: (including hot water, cold water and return piping) Paint 3 inch wide bands of 'Green' at intervals of not more than 10 feet and at all points where piping penetrate through walls, floors and roofs.

1) Includes cold water piping, hot water piping and hot water return piping.

b. Non-potable water: Paint 3 inch wide bands of 'Green' at intervals of not more than 10 feet and at all points where piping penetrate through walls, floors and roofs.

F. Prime and paint insulated and exposed cold pipes, conduit, electrical boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are located in storage, mechanical or equipment spaces or those items which are factory prefinished.

G. Exposed to view un-insulated hot pipes within finished painted areas: Two coats heat-resistant enamel conforming to Federal Specification TT-E-496, Type I, applied when surfaces are less than 140 degrees Fahrenheit.

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SECTION 10 14 16

PLAQUES

## 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 metal plaques.

### 1.03 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Plaques: Half-size Sample.
2. Exposed Accessories: Half-size Sample of each accessory type.

E. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PLAQUES

A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.R.K. Ramos.
b. ACE Sign Systems, Inc.
c. Gemini Signage; Gemini, Inc.

2. Plaque Material: Cast bronze
3. Plaque Thickness: 0.50 inch
4. Finishes:

a. Integral Metal Finish: As selected by Architect from full range of industry finishes
b. Overcoat: Manufacturer's standard baked-on clear coating

5. Background Texture: As selected by Architect from manufacturer's full range.
6. Integrally Cast Border Style: Square single line, polished
7. Applied Frame Material, Style, and Finish: As indicated on Drawings
8. Mounting: [As indicated on Drawings] [Concealed studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Adhesive] [Two-face tape] <Insert requirement>.
9. Text and Typeface: Accessible raised characters and Braille & Typeface as selected by Architect from manufacturer's full range

## 2.02 MATERIALS

A. Bronze Castings: ASTM B584, alloy recommended by manufacturer and finisher for finish indicated

B. Bronze Plate: ASTM B36/B36M, alloy recommended by manufacturer and finisher for finish indicated

## 2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.

3. Plaque Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.
    b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

B. Adhesive: As recommended by plaque manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.04 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

## 2.05 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install bracket supports in position, so that plaque is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of plaque and of suitable quantity to support weight of plaque after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as plaque is applied and to prevent visibility of cured adhesive at plaque edges. Place plaque in position, and push to engage adhesive. Temporarily support plaque in position until adhesive fully sets.
5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of plaque and of suitable quantity to support weight of plaque without slippage. Keep strips away from edges to prevent visibility at plaque edges. Place plaque in position, and push to engage tape adhesive.
6. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach plaques to plate using method specified above.

## 3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 14 19

DIMENSIONAL LETTER SIGNAGE

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:

1. Cast dimensional characters.

2. Related Requirements:
   a. Section 13 42 00: PRE-ENGINEERED METAL BUILDING; For coordination of dimensional letter signage in metal panel wall assemblies.

### 1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.03 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

B. Thermal Movements: For exterior fabricated channel dimensional characters >, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

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.

2.02 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.R.K. Ramos.
b. ASI Sign Systems, Inc.
c. Gemini Incorporated.

2. Character Material: Cast aluminum
3. Character Height: As indicated on Drawings
4. Finishes:

a. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designation aluminum finishes

1. Shop-applied Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 2605, NAAMM - MetalFinishes Manual, and the following:

a. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000 ".

b. Finish Coating shall be manufactured as one of the following products:

1) Akzo Nobel; product: "Trinar Ultra."
2) P.P.G. Industries Inc.; product "Duranar."
3) Valspar Corp., product: "Fluropon."

c. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.

d. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.

e. Shop finish with one color coat, of polyvinylidene flouride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.

5. Mounting: Concealed studs

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

4. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.04 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of

sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION

SECTION 10 14 23.16

ROOM-IDENTIFICATION PANEL SIGNAGE

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes identification signs for rooms and exit signs that are directly attached to building walls or doors.

B. Related Requirements:
   1. Section 08 17 43- AF COMPOSITE DOORS
   2. Section 09 29 00 – GYPSUM BOARD: For coordination mounting room signage on adjacent walls from doors.

### 1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room identification exit signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size

C. Samples: For each exposed product and for each color and texture specified.

### 1.03 INFORMATIONAL SUBMITTALS

A. Sample warranty.

### 1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

### 1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in ANSI A117.1, 2009.

2.02 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign, Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASI Sign Systems, Inc.
b. Signature Signs, Inc.
c. Signs & Decal Corp.

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign
b. Surface-Applied Graphics: Applied photo image
c. Subsurface Graphics: Reverse halftone or dot-screen image
d. Color(s): As selected by Architect from manufacturer's full range

3. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition at Vertical Edges & Horizontal Edges: Square cut
b. Corner Condition in Elevation: Square

4. Mounting: adhesive

2.03 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings

## 2.04 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.

3. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

## 2.05 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for blocking of overhead toilet partitions, floor mounted and overhead braced.
2. Section 09 22 16 "Non-Structural Metal Framing" for blocking.
3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

### 1.02 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall.

### 1.03 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For solid-plastic toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: Actual sample of finished products for each type of toilet compartment indicated.

1. Size: 6-inch- square, of same thickness indicated for Work.
2. Include each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

## 1.04 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Product Certificates: For each type of toilet compartment by manufacturer.

## 1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments.

## 1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge with associated fasteners.
2. Latch and Keeper: One latch and keeper with associated fasteners.
3. Door Bumper: One bumper with associated fasteners.
4. Door Pull: Two door pull(s) with associated fasteners.
5. Fasteners: 10 fasteners of each size and type.

## 1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

# PART 2 - PRODUCTS

## 2.01 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Regulatory Requirements: Comply with applicable provisions in for toilet compartments designated as accessible ICC, ANSI A117.1, 2009.

## 2.02 SOLID-PLASTIC TOILET COMPARTMENTS

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. ASI Global Partitions.
2. General Partitions Mfg. Corp.
3. Scranton Products.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color and Pattern: as selected by Architect from manufacturer's full range

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.

1. Polymer Color and Pattern: Contrasting with pilaster, as selected by Architect from manufacturer's full range

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or extruded aluminum.

a. Polymer Color and Pattern: Contrasting with panel, as selected by Architect from manufacturer's full range

G. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid polymer.

## 2.03 HARDWARE AND ACCESSORIES

A. Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch- thick stainless steel, cam type that swings to a closed or partially open position allowing emergency access by lifting door. Mount with through bolts.
2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast-stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply

with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.

3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast-stainless steel bumper at outswinging doors Mount with through bolts.
5. Door Pull: Manufacturer's heavy-duty, cast-stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.04 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Brass Castings: ASTM B584.

D. Brass Extrusions: ASTM B455.

E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

F. Stainless Steel Castings: ASTM A743/A743M.

G. Zamac: ASTM B86, commercial zinc-alloy die castings.

## 2.05 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts.

E. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet compartments and 36-inch- wide, outswinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF PLASTIC TOILET COMPARTMENTS

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls with full-height brackets.

a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust, so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.03 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10 22 13

WIRE MESH PARTITIONS

## 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. Heavy-duty wire mesh partitions with passage doors and hardware.

### 1.3 DEFINITIONS

A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.

B. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate clearances required for operation of doors

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: 12-by-12-inch panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

E. Delegated-Design Submittal: For wire mesh partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

## 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wire mesh partition hardware to include in maintenance manuals.

## 1.7 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. Door Locks: Furnish 5 percent of quantity installed for each type indicated, but no fewer than 10 locks.

## 1.8 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Inventory wire mesh partition door hardware on receipt and provide secure lockup for wire mesh partition door hardware delivered to Project site.

1. Tag each item or package separately with identification and include basic installation instructions with each item or package.

## 1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Acorn Wire & Iron Works.
2. American Wire Corporation.
3. California Wire Products Corporation.
4. Indiana Wire Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design wire mesh units.

B. Structural Performance: Wire mesh units shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft. at any location on a panel.
2. Total load of 300 lbf applied uniformly over each panel.
3. Concentrated load and total load need not be assumed to act concurrently.

C. Seismic Performance: Wire mesh units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5

2.3 MATERIALS

A. Steel Wire: ASTM A510.

B. Steel Plates, Channels, Angles, and Bars: ASTM A36/A36M.

C. Steel Sheet: Cold-rolled steel sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.

D. Steel Pipe: ASTM A53/A53M, Schedule 40, unless another weight is indicated or required by structural loads.

E. Steel Tubing: ASTM A500/A500M, cold-formed structural-steel tubing or ASTM A513, Type 5, mandrel-drawn mechanical tubing.

F. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.

G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.

H. Post-Installed Anchors: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in

concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

I. Power-Driven Fasteners: ICC-ES AC70.

J. Seismic Bracing: Angles with legs not less than 1-1/4 inch wide, formed from 0.040-inch-thick, metallic-coated steel sheet; with bolted connections and 1/4-inch-diameter bolts.

K. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

L. Zinc-Rich Primer: Compatible with topcoat, complying with SSPC-Paint 20 or SSPC-Paint 29.

M. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

## 2.4 HEAVY-DUTY WIRE MESH PARTITIONS

A. Mesh: 0.192-inch-diameter, intermediate-crimp steel wire woven into 2-inch diamond mesh.

B. Mesh: 0.192-inch-diameter steel wire, resistance welded into 1-1/2-by-2-1/2-inch rectangular mesh.

C. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-1/8-inch cold-rolled steel channels; with holes for 3/8-inch-diameter bolts not more than 12 inches o.c.

D. Horizontal Panel Stiffeners: Two cold-rolled steel channels, 1 by 1/2 by 1/8 inch, bolted or riveted toe to toe through mesh.

E. Top Capping Bars: 3-by-1-inch steel channels.

F. Posts for 90-Degree Corners: 1-1/2-by-1-1/2-by-1/8-inch steel angles or tubes or 2-by-2-by-0.075-inch cold-rolled steel angles or tubes, with holes for 3/8-inch-diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch steel base plates.

G. Posts for Other-Than-90-Degree Corners: 2-inch-OD by 1/8-inch steel pipe or round tube, with holes for 3/8-inch-diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch steel base plates.

H. Line Posts: 3-inch-by-4.1-lb or 3-1/2-by-1-1/4-by-1/8-inch steel channels; with 1/4-inch steel base plates.

I. Three-and Four-Way Intersection Posts: 2-by-2-by-0.075-inch steel tubes, with holes for 3/8-inch-diameter bolts aligned for bolting to adjacent panels; with 1/4-inch steel base plates.

J. Floor Shoes: Metal, not less than 2 inches high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.

K. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch steel channels, banded with 1-1/2-by-1/8-inch flat steel bar cover plates on four sides, and with 1/8-inch-thick angle strike bar and cover on strike jamb.

1. Hinges: Full-surface type, 3-1/2-by-3-1/2-inch steel, three per door; bolted, riveted, or welded to door and jamb framing.
2. Padlock Lug: Mortised into door framing and enclosed with steel cover.
3. Cylinder Lock: Mortise type with manufacturer's standard cylinder operated by key outside and lever inside; mounted in lower section of door.
4. Inactive Leaf Hardware: Cane bolt at bottom and chain bolt at top.

L. Accessories:

1. Sheet Metal Base: 0.060-inch-thick, steel sheet.
2. Adjustable Filler Panels: 0.060-inch-thick steel sheet, capable of filling openings from 2 to 12 inches.
3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch of adjustment.

M. Finish: Powder-coated finish unless otherwise indicated.

1. Color: As selected by Architect from manufacturer's full range

## 2.5 FABRICATION

A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.

1. Fabricate wire mesh items to be readily disassembled.
2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint

B. Heavy-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Weld mesh to framing.
2. Framing: Fabricate framing with mortise and tenon corner construction.

a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
b. Fabricate three-and four-way intersections using manufacturer's standard connecting clips and fasteners
c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with 3 to 4 inches of clear space between finished floor and bottom horizontal framing.
4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
5. Doors: Align bottom of door with bottom of adjacent panels.

    a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.

6. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

## 2.6 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine floors for suitable conditions where wire mesh items will be installed.

C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 WIRE MESH PARTITIONS ERECTION

A. Anchor wire mesh partitions to floor with 3/8-inch-diameter postinstalled expansion anchors at 12 inches o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.

B. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing and as follows:

1. For concrete and solid masonry anchorage, use expansion anchors.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

C. Secure top capping bars to top framing channels with 1/4-inch-diameter "U" bolts spaced not more than 28 inches o.c.

D. Provide line posts at locations indicated or, if not indicated, as follows:
1. For partitions that are 7 to 9 feet high, spaced at 15 to 20 feet o.c.

E. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.

F. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.

G. Install doors complete with door hardware.

H. Weld or bolt sheet metal bases to wire mesh partitions and doors.

I. Bolt accessories to wire mesh partition framing.

## 3.3 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 "PAINTING"

E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 10 22 13

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SECTION 10 26 13

WALL AND DOOR PROTECTION

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following where indicated on Drawings.

1. Stainless steel corner guards.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Concealed blocking and nailers.

B. Section 09 29 00 - GYPSUM BOARD: Substrate for wall and corner guards.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

1. ASTM A 167 - Stainless and Heat-resisting Chromium-nickel Steel Plate, Sheet and Strip.
2. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.04 PERFORMANCE REQUIREMENTS

A. Corner guards to resist lateral impact force of 100 pounds at any point without damage.

1.05 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications for each item furnished hereunder.
2. Installation instructions: Indicate installation rough-in measurements and instructions.
3. Manufacturer’s certification: Certify that corner guards, meet or exceed flame spread rating for surface finish.
4. Shop drawings: Large scale details of flush corner guards, showing attachment clips and brackets; termination details, and complete installation details.
5. Selection samples:

a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.

b. Provide samples as requested by Architect for initial selection of colors and finishes

6. Verification samples: 12 inch long samples, each, of flush corner guards, illustrating selected finish.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver wall and corner guards to the project until all concrete, masonry, plaster and other wet work has been completed and dry.

B. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier.

C. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.07 FIELD MEASUREMENTS

A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate the work with wall or partition Sections for installation of concealed blocking or anchor devices.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Stainless steel corner guards;

a. K.J. Miller Corporation, Elkhart IN.

b. Pawling Corporation, Standard Products Division, Pawling NY.

c. Wilkinson Company, Stow OH.

2.02 CORNER GUARDS

A. Stainless steel corner guard (adhered type): Fabricated from 16 gage type 430 stainless steel, polished to a Nº 4, brushed finish, 3-1/2 inch by 3-1/2 inch by 4 feet high, with 3/4 inch bend radius, equal to Wilkinson series "WCG"

B. Adhesive:, Single-component non-sagging gun-grade, low-odor, moisture-curing 100 percent solids polyether, sealant, conforming to ASTM C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ±25 percent, equal to the following:

1. Chem Link, Inc., Schoolcraft MI., product "M-1".

C. Mounting Brackets and attachment hardware: Appropriate to component and substrate.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Predrill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify that field measurements are as indicated on Drawings.

C. Beginning of installation means acceptance of existing substrate and project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position.

B. Position corner guard from finished floor.

3.03 TOLERANCES

A. Maximum variation from required height: 1/4 inch.

B. Maximum variation from level from visible length: 1/4 inch.

## 3.04 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish concealed anchorage devices for handicap handrails for installation under Section 06 10 00 - ROUGH CARPENTRY.

B. Furnish toilet and bath accessory templates, to locate anchorage reinforcement, to trades responsible.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY:

1. Wood blocking.
2. Installation of concealed anchorage devices for grab bars in toilet rooms.

B. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions and metal framing.

C. Section 09 30 13 - CERAMIC TILE: Tiled walls as substrate for toilet accessories.

D. Section 10 21 13 - TOILET COMPARTMENTS.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, for each item furnished hereunder.
2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.
3. Selection samples: Sample color chips indicating each manufacturer's full range of colors available for selection by Engineer.
4. Verification samples: Complete units, as requested by Engineer.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable codes and accessibility regulations, and comply with ANSI A 117.1 for installation of work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier and item identification number corresponding with approved schedule.

B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

B. Coordinate the work of this Section with placement of internal wall reinforcement.

1.08 WARRANTY

A. Deliver to the Owner upon completion of the work of this Section, applicable manufacturer's standard warranties.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufactures and models: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based on manufacturers and model numbers specified herein below. Manufacturers offering products which may be considered as equal include the following:

1. A&J Washroom Accessories, Inc., (A&J) New Windsor NY.
2. American Specialties, Inc. (ASI), Yonkers NY.
3. Bobrick Washroom Equipment, Inc. (Bobrick), Clifton Park NY.
4. Bradley Corporation / Washroom Accessories Division, (Bradley) Menomonee Falls, WI.
5. Meek Manufacturing Company, Inc., Fort Smith AR.
6. Georgia Pacific, Atlanta GA.
7. San Jamar, Elkhorn, WI.
8. Buckeye International, Inc., Maryland Heights, MO.
9. Tork / Essity Professional Hygiene North America, LLC, Philadelphia, PA.

10. Deb USA, Inc., Charlotte, NC.

## 2.02 TOILET ACCESSORIES

A. General:

1. Locks:

   a. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.

2. Factory Finishing:

   a. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.

   b. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.

   c. Stainless steel: Number 4 satin finish, except as otherwise specified above under the Article entitled “Toilet Accessories”.

B. Coat/robe hook: Surface mounted bright polished finish stainless steel double robe hook, fabricated from 22 gage type 304 stainless steel, protrudes from wall nominally 1-7/8 inches.

1. ASI model 7345.
2. Bobrick model B-7672.
3. Gamco model 5154B.

C. Grab bars (of lengths and configurations as indicated on Drawings): Stainless steel, minimum wall thickness 18 gage (Stub’s gage), with non-slip knurled, peened or striated surface.

1. Grab bars: 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover, equal to:

   a. ASI 3700 series.

   b. Bobrick series: B-5806.99.

   c. Gamco series 125ST

D. Mirrors, framed: 18 inches wide by 36 inches high, having the following:

1. Frame: one piece 3/4/ by 3/4 inch type 304 18 gage stainless steel roll formed frame, with continuous integral stiffener on all sides. Corners shall be heliarc welded, ground and polished smooth. corners
2. Back: 20 gage galvanized steel back attached to frame with concealed screws.
3. Mirror glass: 1/4 inch thick safety glass, ASTM C 1048 FT, fully tempered, complying with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1, with Class 1, standard commercial quality, electro-copper back-plating protected by a corrosion-resistant zinc-coating.

4. Acceptable models:
    a. ASI model Nº. 0600-
    b. Bobrick model Nº. 2908-
    c. Gamco "A" series
    d. Meek model Nº. M1210

E. Mop and broom holders: Surface mounted, nominal 44 inch long stainless steel unit with 18 gage 8 inch deep continuous shelf, 5 stainless hooks and 4 mop/broom holders, anti-slip spring loaded, rubber cam mop holders, capable of holding 7/8 to 1-1/4 inch diameter handles.
    1. ASI model 1308B
    2. Bobrick model B-239-44
    3. Gamco model US6

F. Shelving in Janitor's closets: Custodial shelf, stainless steel, 8 inches deep by 30 inches wide with 3/4 inch edge return. Mounting brackets, 16 gage welded to shelf.
    1. ASI model 0692
    2. Bobrick model B-298-30
    3. Gamco model S-8.

G. Sanitary napkin disposal: Surface mounted feminine napkin disposal unit, fabricated of type 304 stainless steel, with one piece cover.
    1. A.S.I., model 0852
    2. Bobrick model B-270 ("Contura" Series)
    3. Gamco model ND-1

H. Sanitary napkin disposal: Partition mounted feminine napkin disposal unit serving two toilet compartments.
    1. ASI model 0472
    2. Bobrick model B-354
    3. Gamco model ND-6

I. Shower curtains and rods:
    1. Curtain rods: 1-1/4 inch diameter, Stainless steel, minimum wall thickness 18 gage (Stub's gage), with stainless steel 2-1/2 inch flange and concealed fasteners. Lengths as required for locations shown on the Drawings.
        a. ASI model 1206
        b. Bobrick model B-6047.
    2. Curtain hooks: 18-8, type 304 Stainless steel, 0.09 inch diameter. Provide one hook for every 6 inches, or fraction thereof of each curtain rod.

3. Polyester shower curtain: white, 100 percent polyester mildew resistant, Teflon coated for water repellency and stain resistance. Fabricate curtain with hemmed edges and a fully weighted, anti-fungus, mildew resistant bottom hem and corrosion-resistant grommets along reinforced top edge every 6 inches (152 mm) on center through top hem.

J. Soap dispensers: Owner Furnished Contractor Installed.

K. Toilet tissue dispenser: Tork 56TR Twin Jumbo Tissue Roll Dispenser, No substitutions.

L. Towel dispenser: San Jamar T1100TBK Lever Roll Towel Dispenser, no substitutions.

M. Semi-recessed waste receptacle: Stainless steel removable, 12-gallon lockable receptacle.

1. ASI model 0458.
2. Bobrick model B-3644.
3. Gamco model WR-6.

2.03 ADA PIPING PROTECTION

A. Specified Product (Basis of Design): IPS Corporation, Collierville, TN., product "Soft Guard Plus".

B. Description: 1/8 inch thick pliable PVC Shell finish Soft Guard Plus on all drainage piping including hot and cold water valve and supplies under lavatories to comply with ADA and UPC standards. Covers shall be secured by custom fit, tamper-resistant snap-to-lock fasteners.

1. Complies with ICC/ANSI A117.1 (sec 606.6).
2. PVC Base Insulation Material, Class A rated complying with 25 Flame Spread/450 Smoke Index (tested under ASTM E-84).

2.04 LOCKS

A. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.

2.05 INSTALLATION ACCESSORIES

A. Fasteners, screws, and bolts: Type 304 stainless, tamperproof.

B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.

2.06 FABRICATION

A. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion, scratches or dents. Weld and grind smooth joints of fabricated components.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

C. Shop assemble components and package complete with anchors and fittings. Hot dip galvanize exposed and painted ferrous metal and fastening devices. Provide steel anchor plates, adapters, and anchor components for installation.

2.07 FACTORY FINISHING

A. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.

B. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.

C. Stainless steel: Number 4 satin finish, except as otherwise specified above under the Article entitled “Toilet Accessories”.

## PART 3 - EXECUTION

3.01 PREPARATION

A. Provide templates and rough-in measurements as required. Deliver inserts and rough-in frames to site at appropriate times for building-in by other trades

B. Coordinate with trades responsible for providing receiving surfaces on which accessories will be installed.

C. Exact locations of accessories within each room or area shall be as directed by the Engineer.

3.02 INSTALLATION

A. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.

B. Install toilet accessories absolutely level and in true line, securely and rigidly anchored with theft proof fasteners of the size and type most appropriate for the specific receiving surface, concealing the fasteners as far as practicable.

3.03 ADJUSTING

A. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.04 CLEANING

A. Remove all protective films and coverings from accessories, and clean and polish each piece. Remove all rubbish, packing materials, and debris, caused by the work of this Section.

END OF SECTION

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SECTION 10 40 00

SAFETY SPECIALTIES

## PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Brackets for wall mounting.
4. Knox box and bollard.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit partitions.

B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

C. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Framed wall openings

D. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard finishes.

E. Division 21 - FIRE SUPPRESSION: Fire hose connections and related cabinets and accessories.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. NFPA 10 – Standard for Portable Fire Extinguishers, 2018 Edition.

1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, indicating: fabrication specifications, finishes, dimensions of cabinet and rough opening, and installation instructions.
2. Shop drawings: Details showing unit dimensions, methods of construction, attachment clips and brackets; and complete installation details.
3. Selection samples: Samples indicating metal finishes available for selection by Engineer.
   a. Provide additional samples as requested by Engineer to facilitate initial selection of colors and finishes
4. Verification samples: Fire extinguisher cabinet in specified size, finishes, and door type, if requested by Engineer.

1.05 REGULATORY REQUIREMENTS

A. Obtain certificate of compliance from authority having jurisdiction indicating approval of fire extinguisher cabinets and their installed locations.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver cabinets or extinguishers to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Store cabinets and extinguishers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.07 WARRANTY

A. Deliver to the Owner upon completion of the work of this Section, applicable manufacturer’s standard warranties.

## PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. J.L. Industries, Bloomington MN.
   2. Larsen Manufacturing Co., Minneapolis MN.
   3. Potter-Roemer, Union NJ.
   4. Amerex Corporation, Trussville, AL (*fire extinguishers only*)

2.02 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

2.03 FIRE EXTINGUISHERS CABINETS AND BRACKETS:

A. Fire extinguisher cabinets:

1. Cabinet trim style: Square trim, semi-recessed cabinet.
   a. Protruding from wall: 1-1/4 inches.
2. Door and trim: White powder-coat finish.
   a. Full glazed design with breakable glazing.
   b. Vigilante alarm: Provide 9 volt, battery operated (battery included), plunger activated. vigilante alarm.
   c. Handles: Red door handles having raised letters “FIRE”.
   d. Lettering: Factory applied die-cut lettering, applied to metal portion of door.
      1) Pattern: Horizontal reading.
      2) Color: Red
3. Cabinet construction: 18 gage cold-rolled steel with factory applied white powder-coat finish, full glass.
4. Acceptable models:
   a. JL Industries “Academy Series”, model number 2026.
   b. Larsen “Architectural Series”, model number AL-2712-RL
   c. Potter-Roemer, “Alta Series”, model number 7025.

B. Wall mounting Bracket: 16 gage steel surface mounted bracket, with red glossy polyester thermo-set coating, equal to the following. Provide with red letter decals spelling “FIRE EXTINGUISHER” applied to wall surface, letter size, style as required by code, location as selected by Engineer.

1. JL Industries, model number “MB-810”.
2. Larsen model number 864.
3. Potter-Roemer, model number 3903.

2.04 FIRE EXTINGUISHERS:

A. Extinguishers: Multi-purpose dry chemical type (mono amonium phosphate),10 pound capacity, multi-purpose rated ‘4A, 60B:C’; with metal valves and siphon tubes, replaceable molded valve stem seals, pressure gauges and hose discharge.

2.05 EMERGENCY KEY CABINETS

A. Fire department emergency access key cabinet (“Knox Box”): Model 4400-R, Knox Rapid Entry System box, heavy duty, recessed mounted as manufactured by The Knox Company, Phoenix, AZ, or equal having the following construction:

1. Housing: 1/4 inch thick plate steel with joints welded.
2. Door: 1/2 inch thick steel plate with neoprene weather seal.
3. Locking: 3 point lock with stainless steel lock cover.
4. Tamper switch: Provide optional UL listed alarm tamper switch.

5. Finish: Aluminum colored polyester powder coat.

B. Key cabinet bollards: Bollard 6 inch by 10 inch post fabricated from Type 304 stainless steel with No. 4 satin finish equal to Gooseneck Stands, Streetsboro, OH, Model No. "106TOW-PRO-001-304" housing or approved equal.

1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

a. Gooseneck Stands, Streetsboro, OH

b. Pedestal Pro, Linden, UT.

c. Wikk Industries, Inc., Greendale WI.

2. Accessories: Surface mounted, concealed (in bollard) mounting bracket.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify that prepared openings are ready to receive extinguisher cabinets.

C. Beginning of installation means acceptance of project conditions.

### 3.02 INSTALLATION

A. Install fire extinguisher cabinets in accordance with manufacturer's instructions in locations indicated, and as additionally directed by regulatory authority having jurisdiction.

B. Do not commence installation of fire extinguisher cabinets until immediately adjacent surfaces have been completely installed and finished.

C. Install cabinets absolutely level and in true line, with units securely anchored to the surrounding construction. Fit trim pieces accurately and tight to adjacent construction.

1. Maximum variation from plumb and level: 1/8 inch.

2. Maximum offset from true dimensional alignment: 1/4 inch.

### 3.03 CLEANING AND ADJUSTMENT

A. Upon completion of the work of this Section in any given area, remove tools, and all packaging and debris from the work area; leave area in broom-clean condition.

B. After adjacent work is complete:

1. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

2. Remove all tape and other packing materials from fire extinguisher cabinets.

3. Thoroughly clean and polish all exterior and interior surfaces of extinguisher cabinets, take care to remove dirt from corners. Clean metal and glass surfaces with mild cleaning agents as recommended by manufacturer.
4. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

END OF SECTION

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SECTION 10 51 13

METAL LOCKERS

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Metal lockers, for complete with all required tops, closures and filler pieces.
2. Wood locker room benches.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Wood framed base for lockers.

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
2. Warranty: Provide sample copies of manufacturers' actual warranties, clearly defining all terms, conditions, and time periods for the coverage thereof.
3. Shop drawings:
   a. 1/4 inch scale (minimum) plans of each area with specified lockers, include layout of all lockers, closures, and filler panels and large scale details of locker construction; and details of accessory items.
   b. Large scale details of locker and bench construction, showing filler panels, sloping top components, attachment clips, brackets and complete installation details.
4. Selection samples: Manufacturer's color chips, comprising at least 8 different colors, for selections by the Engineer.

B. Submit manufacturer’s warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

1.04 QUALITY ASSURANCE

A. Obtain locker and benches from a single manufacturer, or from manufacturers recommended by the prime manufacturer of lockers.

B. Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.05 QUALIFICATIONS

A. Manufacturer, with a minimum of 3 years experience demonstrating previously successful work of the type specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not order or fabricate lockers, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Store lockers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.08 EXTRA MATERIALS

A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance.

1. Provide spare keyed cylinders (with keys), an amount equal to 10 percent of total lockers.
2. Provide two master keys.

B. Clearly label and package extra materials securely to prevent damage.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Debourgh Manufacturing Company, La Junta CO.
2. Lyon Metal Products, Inc., Aurora IL.
3. Penco Products, Inc., Oaks PA.
4. Republic Storage Systems Company, Inc., Canton OH.

## 2.02 MATERIALS

A. Sheet Steel: Mild cold-rolled and leveled steel, free from buckle, scale, and surface imperfections.

B. Fasteners: Cadmium, zinc, or nickel plated steel; exposed bolt heads, slotless type; self-locking nuts or locker washers for nuts on moving parts.

1. Locker assembly fasteners shall be "pop" type rivets with aluminum bodies and steel mandrels. Rivets shall be backed up by washers to ensure correct rivet expansion and secure fastening.

C. Equipment: Hooks and hang rods of cadmium-plated or zinc-plated steel or cast aluminum.

## 2.03 LOCKER TYPES

A. Locker Types:

1. Lockers: Single tier wardrobe locker 18 inches wide by 18 inches deep by 72 inches high at front with sloped tops.

a. General design, Republic Storage Systems Company, Inc., Canton OH; product: “Quiet Series Locker”.

b. Body: Backs, sides, tops, bottoms, shelves and sides minimum 24-gage. Flange tops, bottoms and shelves on four sides, and backs on two sides.

1) Form exposed ends of non-recessed lockers of minimum 16-gage steel.

2) Lower shelf:

a) Standard locker: 6 inches above finished floor.

b) Handicapped accessible locker: 9 inches above finished floor.

3) Top shelf:

a) Standard locker: Manufacturer’s standard height.

b) Handicapped accessible locker: 48 inches above finished floor.

c. Door frame: 16 gage channel or 12 gage angles, with continuous door stop/strike integral with frame on both sides of opening.

d. Door: Flush design without louvers or perforations, 16 gage steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Fabricate to swing 180 degrees.

e. Hinges: 5 knuckle, 2 inch high full loop pin hinge welded to frame and riveted to inside of door flange.

1) Lockers doors greater than 42 inches in height, provide 3 hinges.

f. Door handle:

1) Latch design: operable by “club fist” as required by State of New York Regulation Title 19, *2010 Building Code of New York State (BCNYS)* Chapter 11 and International Code Council/American National

Standards Institute, code standard: ICC/ANSI A117.1-2003 edition, *Standard on Accessible and Usable Buildings and Facilities*.

2) Latching method: three point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides. Provide frame hooks welded to door frame, furnished with soft rubber silencers at each hook.

3) Locking method: door handle latch design capable of receiving user furnished padlocks.

g. Base: Framed wood base provided under Section 06 10 00 – ROUGH CARPENTRY.

h. Sloping tops: 20 gage steel minimum having a sloped rise approximately 18 to 25 degrees, finished to match lockers, in lengths as long as practicable but not less than 4 lockers. Provide closures at ends finish to match lockers.

i. Filler panels: 18 gage steel minimum, factory-fabricated and finished to match locker units.

j. Trim: 18 gage steel minimum; Provide at jambs and head of recessed lockers, finished to match locker units. Secure with concealed fasteners.

k. Accessories:

1) Double prong hook mounted to underside of locker top or back of locker.

2) Hat/book shelf.

3) Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.

## 2.04 LOCKER ROOM BENCHES

A. Movable benches, factory fabricated:

1. Tops: Laminated maple, 12 inches wide by 1-1/4 inches thick of lengths indicated, sealed with two coats of clear lacquer.

2. Legs: Heavy-duty pedestal-type supports fabricated from 1 ½ inch diameter welded steel tubing with a shop applied baked enamel finish to match locker color.

3. Overall seating height shall be between 17-1/2 to 18 inches.

B. ADA Bench: 24 inch by 48 inch solid wood bench sealed with two coats of clear lacquer as indicated on the Drawings, with pedestal legs or wall-mounted brackets with baked enamel to match lockers.

## 2.05 FACTORY FINISHING

A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel finish.

1. Colors of locker bodies and doors as selected from manufacturer's standard range. Up to two colors may be selected for each locker type.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.

B. Beginning of installation means acceptance of existing conditions.

### 3.02 PREPARATION

A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled to match original finishes.

### 3.03 INSTALLATION

A. Do not commence installation of lockers until immediately adjacent surfaces have been completely installed and finished.

B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.

C. Furnish and install all sloped top pieces as required, refer to the Drawings for the various conditions.

D. Furnish and install all filler pieces as required to completely fill recesses, and to align with ends of partitions. Refer to the Drawings for the various conditions.

E. Set lockers absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation. Conceal screw heads and bolts as far as practicable, leaving exposed panels completely free from unused bolt holes.

F. Locate locker benches where shown on the Drawings.

### 3.04 ADJUSTING AND CLEANING

A. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

B. Remove all tape and other packing materials from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces.

C. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.05 PROTECTION

A. Protect locker finish surfaces and hardware from damage until Owners Final Acceptance.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Ground set, cone taper, aluminum flagpoles where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
2. Concrete footings.
3. Aluminum flashing collars.
4. Steel baseplate, ground spike and foundation sleeves.

1.02 RELATED REQUIREMENTS

A. Division 31 - EARTHWORK.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. NAAMM: Metal Flagpole Manual.
2. NAAMM/ANSI FP 1001: Metal Flagpole Manual.

1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Materials list of items proposed to be provided under this Section.
2. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
3. Shop drawings: Large scale design details of flagpole assembly including foundation and all accessories.
4. Samples of each item, color and pattern available in the specified grades from the proposed manufacturers.
5. Verification samples: Actual metal sample with applied specified finish
6. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.05 QUALIFICATIONS

A. Installer specializing in applying the work of this Section with a minimum of 3 years experience.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Pole-Tech Company, Inc., E Setauket NY.
2. Aabec Pole Div., Morgan-Francis Co., Inc., Rushville IN.
3. American Flagpole, Div. of Kearney-National Inc., Abingdon VA.
4. Concord Industries, Inc., Addison TX.

2.02 FLAGPOLE

A. Flagpole:

1. Flagpole: Seamless extruded tubing, aluminum complying with ASTM B241, alloy 6063-T6 heat-treated, age hardened, having a minimum wall thickness of 0.188 inch, tensile strength of not less than 30,000 psi and yield point of 25,000 psi.
   a. Exposed height: 30 feet.
   b. Overall height: 36 feet.
   c. Butt diameter: 6 inches.
   d. Top diameter: 3-1/2 inches.
   e. Flag Capacity: 5 by 8 feet.
   f. Flagged wind speed (constant): 115 miles per hour.
   g. Pole construction: Manufacturer's standard seamless, uniform, straight-line cone tapered section above a cylindrical butt section.
   h. Pole sections: Fabricate pole in one piece wherever possible. For field joints, use internal splicing sleeve for weather-tight and invisible seams.
2. Base: Provide manufacturer's standard ground-set base and anchorage system, including necessary accessories.

a. Foundation Sleeve: 16 gauge galvanized corrugated steel tube, 3 to 4 inches larger in diameter than the butt diameter of the flagpole, with 1/2 inch thick galvanized steel support plate welded to spike.

b. Lightning Protection: 3/4 inch diameter, steel lightning protector ground spike welded to base plate and to support plate, minimum 36 inches long.

c. Flash collar: Spun aluminum, 14 inch outside diameter. Finish to match flagpole shaft.

## 2.03 ACCESSORIES

A. Accessories: Manufacturer's standard to suit size and type of pole, as follows:

1. Finial ball: 5 inch diameter, 14 gage spun aluminum ball.
2. Halyard: #10, 5/16 inch diameter polypropylene white rope.
3. Snap hooks - chrome plated bronze, 3-1/3 inch long with swivel eye. Provide two per each halyard.
4. Counterweight: 3-1/2 inch neoprene coated counter weight and beaded nylon retaining ring.
5. Cleat cover - cast aluminum. manufacturer’s standard.
6. Cleat - internally mounted cam-action cleat with integral sheave, factory mounted.
7. Truck - all aluminum 356 alloy die cast fixed truck to have two cast nylon sheaves.

B. Finishes:

1. Flagpole shaft and fittings: with natural clear 0.7 mil anodized finish NAAMM-M32C22A41.
   a. Paint portion of pole in the ground with black asphaltic coating inside and outside.
2. Finial ball: Gold anodized aluminum.

## 2.04 CONCRETE

A. Concrete Footings:

1. Construct concrete footings and cast-in-place concrete where shown on the Drawings
2. Concrete for footings shall be 4,000 lb. air-entrained mixture.
3. Place concrete on moist subgrade or against prepared footings in continuous operation. Vibrate all concrete. Do not place concrete in freezing temperatures or on frozen base. Pour concrete in alternate sections.
4. Reinforce footings and cast-in-place items as shown on Drawings.
5. All applicable parts of these Specifications referring to Cast-in-Place Concrete and all applicable parts of the structural drawings shall apply for forming,

reinforcing workmanship and quality control for all work specified hereinabove. Provide shop drawings for items where reinforcing is indicated on the Drawings.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify location of anchorage items.

C. Beginning of installation means acceptance of existing site conditions.

3.02 INSTALLATION - FLAGPOLES

A. Excavate for foundation concrete to neat clean lines in undisturbed soil. Provide forms where required due to unstable soil conditions. Remove wood, loose soil rubbish and other foreign matter from excavation, and moisten earth before placing concrete.

B. Provide concrete foundation in accordance with the requirements of Section 03 30 00 – CAST-IN-PLACE CONCRETE and in accordance with flagpole manufacturer's instructions. Location shall be as shown on the Drawings.

C. Install flagpole plumb and true, and firmly wedged into foundation sleeve; install accessories, all in accordance with manufacturer's instructions and in compliance with the reviewed and accepted shop drawings. Provide positive lightning ground for each flagpole installation.

D. The completed installation shall be left free of blemishes and in perfect operating condition.

3.03 CLEANING

A. Upon completion of the work of this Section remove tools, equipment and all rubbish and debris from the work area; leave area in rake-clean condition.

END OF SECTION

SECTION 11 11 26

VEHICLE WASHING EQUIPMENT

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS:

A. Examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

B. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under Contract.

C. It is the intent of the Specifications and the Drawings to require that the equipment to be furnished complete in every respect, and that the General Contractor shall provide all equipment needed and usually furnished in connection with such systems to provide a complete installation. Equipment, materials, and articles incorporated in the work shall be new and of the best grade of their respective kinds.

D. The vehicle washing system shall consist of a manual wash system and an automatic undercarriage wash system. The manual wash water shall be pre-heated by a water heater. Soap for the manual wash system shall be added to the water via in-line mixing after the pump outlet.

1.02 WORK INCLUDED:

This Section includes vehicle washing equipment:

A. Manual pressure washer system with hose festoon
B. Automatic undercarriage wash system

1.03 RELATED WORK:

A. Division 31, SITEWORK
B. Division 3, CONCRETE
C. Division 22, PLUMBING
D. Division 23, HEATING AND VENTILATION
E. Division 26, ELECTRICAL

1.04 REFERENCES

A. National Electric Code (NEC) Articles 430 and 670
B. National Fire Protections Association (NFPA) Standard 79 (Industrial Machinery).

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. The use of specific requirements set forth in the Contract Documents are not intended to preclude use of any other acceptable manufacturer's product which may be equivalent but are given for the purpose of establishing a standard of design, function, and quality of materials, construction, and workmanship.

B. Submit manufacturer's product data and installation instructions for each item of vehicle washing equipment, including data indicating compliance with requirements. Include operating and maintenance instructions for each item of vehicle washing equipment.

C. Submit shop drawings detailing installation of vehicle washing equipment to the Engineer for review prior to the fabrication or manufacturing of any equipment. Include plans, elevations, and details showing layout and types of equipment required. Show anchorages and accessory items. Furnish roughing-in drawings for mechanical, plumbing and electrical services well in advance of concrete and masonry work.

D. Submit shop drawings showing the inverts and layout of all sub-grade piping and settling tanks/sumps associated with the vehicle wash equipment demonstrating that the system will drain and operate properly.

E. Vehicle wash system shall be pre-assembled and full function tested at the factory prior to shipping to the job site. Test reports shall be provided with submittal documents verifying the factory test results.

F. Submit a written warranty, executed by the manufacturer of each item specified, agreeing to repair or replace vehicle washing equipment or their components that fail in materials or workmanship within the specified warranty period. The warranty shall include all costs for labor, materials, and equipment. The warranty shall be a full warranty covering the complete cost of repairs and replacement, and shall not be a pro-rated warranty.

G. Submit three (3) sets of bound maintenance and operating manuals, including operating and maintenance instructions, emergency information, spare parts list and similar information, for each item of vehicle washing equipment required.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm with at least five (5) years' experience manufacturing vehicle-washing equipment and can provide at least five (5) references of successful in-service performance of similar systems, with at least one system in the New England area.

B. Installer Qualifications: Vehicle washing equipment manufacturer or an

experienced installer approved by the vehicle washing equipment manufacturer with at least 8 years of experience who has completed vehicle washing equipment installations similar in material, design, and extent to that indicated for this Project, who has a record of successful in-service performance, and who services and maintains the type of equipment installed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver vehicle-washing equipment to Project site in original unopened containers or packages, with manufacturer's labels, and instructions intact and legible.

B. Handle, store, and protect vehicle-washing equipment in accordance with manufacturer's recommendations.

1.08 COORDINATION

A. Coordinate equipment layout and installation with building and site conditions.

B. General Contractor shall be responsible for notification to, and coordination with, other trades. If the equipment provided differs from that specified herein, General Contractor shall provide all relevant data and requirements, including all material, equipment, and labor needed, including work by other trades (e.g., electrical, mechanical, plumbing, etc.) required for a complete and operational system.

C. Coordinate locations and requirements of service-utility connections.

D. Verify size, location, and requirements of concrete bases, trench drains, and positive slopes to drains for their suitability for the entire system.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Vehicle wash systems shall be of commercial-duty, and satisfactorily clean the Owner's fleet including trucks, and all street legal public works vehicles up to 14' high, 12' wide, and 48' long for front, roof, rear, and both sides.

B. The supplier is to be responsible for the supply of necessary equipment, materials and service for the complete assembly and erection of the equipment so that it is ready for operation as per all applicable specifications.

C. Section includes associated components, fittings, and accessories, including but not necessarily limited to, the following:

1. VEHICLE WASH SYSTEM COMPONETS

a. Manual Pressure Washer (Pressure Plant) (V-1)
b. Manual Wash Control Panel (V-1A)
c. Manual Pressure Washer Soap Injection System (V-1/V-7)
d. Water Heater (V-2)
e. Vehicle Wash Festoon (V-3)
f. Automatic Undercarriage Wash Pump and Wheel Washer (V-4, V-12)
g. Undercarriage Pump Control Panel (V-4A)
h. Automatic Undercarriage Photo Eyes (V-5)
i. Remote Wall Mounted Vehicle Wash Pressure Washer Controls (V-6)
j. Vehicle Wash Guide Rails (V-8)
k. 1,500-Gallon Pre-Treatment Tank (V-9)
l. Mobile Platform (V-10)
m. Vehicle Wash Entry Traffic Light (V-11)
n. Undercarriage Activation Light (V-13)
o. Undercarriage Wash Control Station (V-14)
p. Prefabricated Undercarriage Wash Trench Drains

D. The General Contractor shall provide a complete and operable system. The specifications and drawings are intended to show the general layout and description of the system only and are not intended to show all components necessary for a complete and operable system. The wash system manufacturer may propose alternate equipment/piping arrangements which may be acceptable provided they demonstrate that the equipment will meet the intent of the design and will operate in a satisfactory manner.

## 2.02 MANUAL PRESSURE WASHER SYSTEM WITH HOSE FESTOON SYSTEM

A. Specifications are based on equipment identified herein to establish minimal acceptable standards of quality, features, performance, and construction.

B. Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, may be considered as equal.

## 2.03 MANUAL PRESSURE WASHER (V-1 and V-1A)

A. Material Properties:

1. Vehicle pressure washer unit shall allow for remote location of the pressure washer, delivering heated water through extended length hoses and festoon equipment. Unit specified is based on equipment supplied and manufactured by Maintenance Technology of Portland Maine, contact Joe Kaper at 207-831-7230. Specifications are intended to provide a minimum standard and other approved equals shall be considered.

2. Unit shall deliver not less than 9.8 GPM at 1,100 PSI pressure.
3. Unit shall contain a 7.5 hp electric motor with a direct drive triplex pump system to deliver a pressurized water stream. Motor shall be of the totally enclosed fan cooled type (TEFC) and equipped with overload protection. Pump shall have a 5 year limited manufacturer's warranty against wash out.
4. Unit shall be rated for 480 Volt electrical service, 3 phase.
5. Unit shall have adjustable detergent injection system and controls, and shall be integrated with the detergent drum as indicated below in accordance with manufacturer recommendations.
6. Unit shall be equipped with two (2) low voltage, remote location, soap, rinse, and emergency stop illuminated push button control station (V-6), mounted in wash bay in location on drawings.
7. Each remote station shall be secured in a stainless steel, NEMA 4X rated waterproof enclosure and shall include appropriate legend and instructions for use. All wiring for the controls shall be supplied and installed by the General Contractor. All conduit for the control wiring shall be provided by the Electrical Contractor. Conduit shall be PVC and/or PVC coated galvanized steel in accordance with NY and National Electric Codes.
8. The remote stations shall be mounted at a useable location in close proximity to the pressure wand stand.
9. Cabinet housing electrical controls and motor shall be water resistant. Controls shall be provided for water temperature adjustment and motor controls.
10. Water shall be delivered by an insulated trigger gun, rated to 3,000 PSI, shall be 36 inches in length and equipped with insulated grip. Two pressure washing wand/handle units shall be provided with the unit as described below. Washer wand/handle shall be provided with "V- jet nozzle".
11. Pressure washer guns shall be equipped with switch which will draw soap from the soap drum on demand.
12. Unit shall be ETL-Certified to UL-1776 safety standards.
13. Pressure washer shall be equipped with a siphon tube to draw soap from a 55 gallon drum and deliver the soap to the pressure washer guns. The detergent injection point shall be located downstream of the pumping and heating plant. The main pressure production pump shall not be exposed to any detergent and shall pump only feed water. The chemical injection must be able to provide a specific volume of the liquid detergent without a change in the system water pressure or volume.
14. The high pressure production pump shall be equipped with a stainless steel pulse pump with ceramic plunger. The pulse pump shall be capable of detergent injection up to 3,000 psi and not less than 11 gph and shall be furnished with a stainless steel fixed proportion changeable metering tip. Detergent injection rate shall be able to be adjusted by the Owner.
15. The pumping plant frame shall be constructed of type 304 X 3/16-inch X 1.5-inch stainless steel tube.
16. Unit shall be furnished with a high pressure system regulator and gauge to control the system pressure.
17. Unit shall be furnished with appropriate safety devices to include but not limited to thermal and pressure relief valves.

18. The motor controller shall be housed in a separate nonmetallic NEMA 4 cabinet. The cabinet shall not be physically attached to the pumping plant and shall include a main disconnect with a through door handle, fuse protection, variable frequency drive, PLC controller, and a door mounted touch screen display to facilitate user interface, setup and provide relevant diagnostic information.
19. Unit shall be equipped with an automatic start and stop functions.

2.04 The piping from the pressure washer to the wands in the vehicle wash bays shall be 0.5-inch minimum stainless steel rated to appropriate pressure and supplied with appropriate fittings to provide necessary flow rate of 9.8 GPM, in accordance with vehicle wash manufacturer requirements.

2.05 WATER HEATER (V-2)

A. General Contractor shall supply a water heater as indicated on the drawings. Water heater shall conform to the following requirements:
1. Rated for 285,000 Btu/hr
2. Equipped with a 125-gallon storage capacity.
3. Rated for 332 GPH at a 100 degree F rise
4. Hot what heater shall have 96% thermal efficiency
5. Modular Burner with 5:1 Turndown
6. Operates at temperatures up to 180 degrees Fahrenheit
7. Equipped with a stainless-steel heat exchanger
8. Equipped with a glass-lined steel tank
9. Operating pressure up to 150 PSI
10. Meet ASME Construction Standards (SNA151-501)
11. Includes an ASME Temperature and Pressure Relief Valve
12. Zero clearances to combustible material
13. Roof top and sidewall venting
14. Side wall vent termination
15. Controls shall include the following features:
a. LCD Display
b. Time Clock
c. Night Set back
d. Alarm contacts
e. Run time contacts
f. Manual reset High limit
g. 3 water temperature sensors
h. Flue temperature sensor
i. Contacts for louvers
16. Hot water heater shall come with a 3 year limited warranty and a 1 year warranty for parts.
17. Shall be 100% effective against lime scale build up on tank and heating surfaces.
18. Hot water heater shall AHRI Certified
19. Hot water heater shall be as manufactured by Lochinvar Model number SNA286-125, or approved equal.

## 2.06 MANUAL WASH SYSTEM - HOSE FESTOON (V-3)

A. HOSE FESTOON:

1. The vehicle pressure washer system shall be provided with two hose festoon systems as shown on the drawings. The hose festoon shall be equipped with stainless steel components. The cable shall be PVC/nylon coated, or equal, to prevent corrosion. Each hose/festoon system shall come with a stainless steel wand holder mounted to the floor. Each hose/festoon system shall come furnished, with a high pressure (HP) gun, with an appropriate wand, (bent for trucks). Each wand shall be equipped with a 2507 size stainless steel v-jet nozzle or approved equal. The hose/festoon/wand system shall be equipped with appropriate swivel units, hose reels/brackets, and all other accessories as needed, in accordance with manufacturer recommendations, in order to provide a complete and operable system. The hose/festoon/wand system, and all other vehicle wash system components located in the vehicle wash bay shall be stainless steel, in order to prevent corrosion in a wash bay environment (highly wet and corrosive due to soap and salt). A total of two (2) stainless steel truck pressure washer wands, 3 foot minimum, as manufactured by Mosmatic or equal, with a stainless steel support bracket and truck rated spray nozzles, mounted at the locations shown on the drawings, shall be provided.

2. The hose length shall be verified by the manufacturer, and approved by the Engineer, and shall allow complete access to the wash bay in order to easily wash vehicles/equipment.

3. General Contractor shall provide stainless steel quick release coupler, at the end of each high-pressure hose, to allow easy transition between the vehicle wash gun and other vehicle wash accessories.

## 2.07 CLEANING CHEMICAL(S) (V-7)

A. The General Contractor shall provide one (1) drum of soap/cleaning agent (55 gallons) for the manual wash system in accordance with the manufacturers requirements.

B. The manual wash soap storage container shall be connected to the pressure washer system, in accordance with manufacturer recommendations. The pressure washer system shall be capable of controlling the delivery of soap through the pressure washer wand/trigger gun by the user, in order to provide soap/water mix or clean water, on demand. The user shall be able to control the soap supply to the gun easily using an on/off switch mechanism, located in the wash bay at each wand/trigger gun location (two total). The Owner shall be able to adjust the concentration of the soap/water mixture being delivered in the vehicle wash equipment room.

C. The manufacturer(s) shall not require the Owner to purchase cleaning chemicals from a specified dedicated chemical brand or supplier for the purposes of equipment pricing, performance, or warranty.

2.08 FIXED CHASSIS AND WHEEL WASHER WITH HIGH IMPACT COMPONENTS (V-4, V-12)

A. Capability:

1. The proposed system shall be a completely automatic, drive through style system capable of washing a diverse fleet of Trucks, Tractors, Buses, Vans, and Cars. The equipment shall feature the ability to start and stop water spray to effectively rinse the lower side surfaces, under side, wheels and tires of the operator's vehicle fleet.

B. Operation

A. The high pressure chassis wash manifolds and rotary side sprayer sets shall be located at the entrance to a drive through type bay in such a fashion to allow a vehicle to drive over and through the wash equipment without interruption to the vehicles movement. The bay fixtures include (2) stainless steel under chassis washer manifolds, (4) rotary wheel washers. As the vehicle approaches the high impact wash equipment a high pressure water spray will be effectively delivered to the lower front area of the approaching vehicle through a set of, floor mounted rotary style, gimbal mounted, delivery spinner pedestals. When the vehicle moves over the top of the dual set of under chassis washer manifolds, a portion of the water stream will be directed through a pneumatically actuated ball valve and delivered to the underside of the vehicle. When the vehicle clears the under chassis wash the spray will stop and the high pressure pedestals will continue to deliver increased water spray to the rear of the vehicle.

C. Dual Chassis and Wheel Washer

1. The dual chassis and wheel washer system shall be designed to operate and efficiently target wheels, tires, rocker panels, tire treads, and under chassis of most vehicles. The system shall be designed to operate utilizing 100 gpm at 340 psi. The unit shall be selectable for manual or automatic operation. The automated operation shall interface with the primary truck wash and use a through beam set of infrared type photo eyes for activation.
2. The Under Chassis shall include two stainless steel constructed, fixed nozzle, spray manifolds with manual valves at each assembly. The General Contractor shall furnish the pre-fabricated undercarriage wash trench drains with H-20 wheel load rated cast iron grates. The pre-fabricated trench drains shall be installed by the Plumbing Contractor. The General Contractor shall modify the cast iron grates by drilling holes in strategic locations to match up with the undercarriage wash spray manifold nozzles. The vehicle wash manufacturer shall fabricate stainless steel vertical flanges that sit in the trenches to support the spray manifold off the bottom of the pre-sloped trench drains.

3. The Wheel Washer shall be constructed of stainless steel and include two dual rotary spinner type, high impact, rocker and wheel washer assemblies. The delivery devices shall be a high pressure, four bearing swivel constructed of stainless steel. Each swivel shall be rated for 5000 psi continuous duty and a maximum rotary rating of not less than 2000 rpm and 220 degrees F. All associated bay fixtures and fasteners must be constructed of 304 stainless steel.
4. The equipment shall be constructed primarily of type 304 stainless steel. The pump manifold shall not be less than 2", type 304, schedule 40, pipe. Manifold fittings must be TIG welded. Threaded pipe fittings on manifold construction are unacceptable. The Under Chassis Manifold must be constructed of Type 304 stainless steel, schedule 40 pipe secured directly to a 1/4", reinforced, stainless steel, drive plate with the ability to lock into a pre-formed concrete floor depression without the use of fasteners. The pump stand frame shall be constructed of, 4"X4", type 304 stainless steel, 3/16" square tubing. Total dimension of the pump skid shall not exceed 32" width X 78" height X 96" length
5. The entire pump skid must be pre-assembled, pre-wired and wet tested prior to shipment. The physical pump plant must be completely self-contained and transportable as a single unit to include, pump, and motor, electrical distribution, control center, automation, manifold, valves and tank. The entire skid must be assembled in such a fashion to allow transit through a standard 32" X 80" commercial door way. The buffer tank must be permanently lashed to the stainless steel pump frame structure using 1", ultra-abrasion resistant nylon, ratchetting type, tie down straps. The straps shall include stainless steel hooks and have a load rating not less than 400 lbs.
6. The motor controller must be a non-metallic, NEMA 4, rating with stainless steel hardware. Powder coated or painted steel enclosures are not acceptable. The control panel must include a main disconnect with a through door handle, fuse protection, variable frequency drive, PLC controller, and a door mounted touch screen display to facilitate user interface. The machinery must be capable of operating on 3-phase - 208 Volt - 60 cycle - 110 amp service where required. The unit shall be capable of connection to an independent 120VAC, 20Amp, and isolated control voltage. Output control voltage shall be 24VDC and supplied from factory integrated, current limiting, switching type electronic power supply with discrete surge suppression and primary power filtration. All motors must be of the TEFC type and all valves must be IP68 rated for wash down service including molded DIN plug quick connectors.
7. The machinery will include a PLC that houses the input and output modules and operates a ladder logic program that will sequence all events. Relays used for logic and discrete timers will not be allowed. In addition, the system shall be equipped with a human- machine- interface that features touch screen control. This control shall be capable of expanded diagnostics, user selectable operational attributes, hour meters, I/O service status, selective output operation and a colored screen that indicates service status. All wash equipment shall be hi-speed network ready so that the ladder program can be accessed directly by the OEM. A hi-speed "ready to accept" Ethernet communication hub and protocol shall be considered standard equipment and factory installed in the control panel.
8. The pump must be a vertical, multistage, centrifugal pump with suction and discharge ports on the same level. The pump head and base may be cast iron. All other wetted

parts must be stainless steel construction. The pump must have a maximum working pressure of not less than 435PSI @ 250 deg. F and a design operational specification of 150gpm at 340psi. The pump shall be direct drive by a TEFC, Premium Efficiency, 3525rpm, 40Hp, 3 phase, AC motor. Pump shall be fitted with 2.5" ANSI flanges. Pump specifications are based on a Grundfos 32-10 A-G-A-E-HQQE and must concur with a ISO9906:2012 3 B tolerance standard. The motor nameplate must be UL and CSA recognized.

9. The Wheel Washer shall be constructed of stainless steel and include (4) dual rotary spinner type, high impact, rocker and wheel washer assemblies. The delivery devices shall be a high pressure, four bearing swivel constructed of stainless steel. Each swivel shall be rated for 5000psi continuous duty and a maximum rotary rating of not less than 2000rpm and 220 deg. F. All associated bay fixtures and fasteners must be constructed of type 304 Stainless Steel.
10. The water flow discharge valves associated with this system must be capable of directing the pressurized water flow from the pumping plant to the water spray manifolds at the entrance sprayers, 1st under chassis, 2nd under chassis and exiting sprayers. The valves shall be not less than 1", full port, and pneumatically operated ball valves with a pressure rating of 600psi. The brass bodied valve must be certified lead free and include PTFE with dual FKM stem seals and PTFE ball seats. The valve actuator must have a cycle time of less than one second at a nominal working air pressure of 80psi and include CE and ISO5211 Marks.
11. The pump buffer tank must be manufactured from medium-density polyethylene with ultra violet inhibitors and designed for containment of liquids of up to 1.7 specific gravity. Tank walls shall be translucent for liquid level viewing and labeled with gallon indicator markings. The tank shall be supplied with a 16" vented lid and (2) 2" FPT, Poly Propylene, Bulk Head Type Fittings. The tank capacity may not be less than 400 gallon total capacity. The tank must also include appropriately sized, pneumatically operated fill valve and required floats.
12. One set of long range, IP68 rated, infrared proximity sensors shall be provided at the entrance to the wash bay to activate the automatic wash operations.
13. The General Contractor shall provide a green activation light (V-13) mounted in the wash bay that will turn on when the undercarriage wash system has been armed. The light shall be suited for a wash bay environment and shall be located so that the driver and personnel in the wash bay can see it. Coordinate final location with Owner and Engineer. Light shall have signage that indicates the undercarriage wash system is armed/on when the light is illuminated.
14. The General Contractor shall provide a green and red stop light (V-11) mounted outside the wash bay entrance that will turn green when the undercarriage wash system has been activated. The light shall turn red when system is off/not armed. The light shall be suited for outdoor use in a weatherproof enclosure. The light shall be easily visible from approaching vehicles. Coordinate final location with Owner and Engineer. Light shall have signage that indicates the undercarriage wash system is armed/on when the green light is illuminated.
15. The undercarriage wash system shall be supplied with one (1) low voltage, remote location, illuminated push button control station with on/off button and a toggle switch (VW-14) to switch between automatic and manual mode per the drawings/details, mounted in wash bay in location on drawings.

16. Remote station shall be secured in a stainless steel, NEMA 4X rated waterproof enclosure and shall include appropriate legend and instructions for use. All wiring for the controls shall be supplied and installed by the vehicle wash manufacturer. All conduit for the control wiring shall be provided by the Electrical Contractor. Conduit shall be PVC and/or PVC coated galvanized steel in accordance with NY and National Electric Codes.

D. Utility Requirements

1. Electrical Service:

   a. 460V/3phase 40hp

2. Compressed Air:

   a. 80-100 psi, 3 cfm, clean, dry air.
      Terminate at ball valve with 1/2" fpt

3. Fresh Water:

   a. 50gpm @ 40psi minimum requirement
      Terminate at ball valve with 1.5" fpt
      RPZ/Backflow, as required by code.

2.09 PRE-CAST UNDERGROUND WASH PRETREATMENT TANKS (V-9):

A. This section covers the construction and installation of one (1) 1,500-gallon two-compartment pre-cast underground wash water pretreatment tank.

1. The tank shall be standard horizontal type of reinforced concrete construction designed to withstand HS-20 loading, and having a working capacity of 1,500 gallons. The concrete shall be a minimum of 5,000 psi concrete, and shall have a minimum wall thickness of 6 inches. The outside of the pre-treatment tanks shall be coated with AQUA-SAFE Concrete Sealer as manufactured by Bay Oil Company or approved equal. The inside of the pre-treatment tanks shall be coated with HYDROZO 100 as manufactured by BASF or approved equal. The coating shall be applied in accordance with manufacturer's recommendations and shall resist high salt content wash water inside and out.
2. The tank shall be watertight having two (2) watertight cast iron covers extending to the grades as shown on the drawings. Each manhole frame shall be designed so that the manhole cover will fit securely and not spin in the frame. Each frame shall incorporate a physical water check system to prevent the entry of surface water into the sump. This system shall include a single vertical gasket and shall incorporate no penetrations. A locking device shall be provided for each manhole.
3. Each manhole cover and frame shall be suitable for use under HS-20 live loads. Frame and cover system shall be cast into the tank concrete cover pad to prevent

transference of surface loads to the tanks.

4. Each manhole cover shall include a lifting handle provided by the manufacturer. Each handle shall be formed with 1/8-inch stainless steel tubing with alloy casting for the key and a plastic grip. Each handle shall include a foot lever tool and a locking tool.
5. Manhole cover, frame, and skirt assemblies shall be provided in the tank top slab over tank openings. The Drawings show number, size, and location of manhole assemblies required for each tank top slab. Each manhole assembly shall be United States Foundry ductri frame and covers that conforms to ASTM A48 class 30B or 35B specs, or approved equal.
6. Cover: Each manhole cover and frame shall be suitable for use under HS-20 live loads.
7. Watertight type manhole frames with 32-inch diameter covers (lockable and gasketed) shall be 4 bolt type.
8. Watertight rubber boots or gaskets shall be used at the pipe connections to the tank inlet and outlet. 32-inch frames and covers shall be watertight and provided with 32-inch tank openings. Frame/cover bolts and hardware shall be stainless steel.
9. The tank shall be manufactured in two sections to be delivered to the site and shall be manufactured by Scituate Ray Precast, Marshfield, MA or approved equal.
10. The tank shall be designed to prevent flotation when pumped completely empty. Buoyancy calculations shall be based on groundwater at grade, and the Contractor shall furnish and install field concrete as required by the tank manufacturer to prevent flotation. The anti-buoyancy calculations shall be stamped by a New York professional engineer and the tank shall come equipped with concrete collars, or other components as needed, to provide the necessary weight to prevent tank flotation with groundwater and grade.
11. Tanks shall be placed on properly compacted select backfill as indicated on the contract drawings and per Section 31 20 00 Earthwork.

## 2.10 TIRE GUIDE RAILS (V-8)

A. Tire guides shall be fabricated from 6-inch diameter 5-1/2 foot long galvanized steel piping. Provide guide runs on both sides of the vehicle. The length of the tire guides shall be 11 ft long down both sides of the vehicle. The system shall have an angled entry at the entrance. The ends of the rails are capped and all headings are smoothly finished to prevent tire damage. Brackets supporting pipe shall be made of minimum of 3/8” steel plate that are welded to concrete imbedded cleats or anchor bolted to the concrete. Tire guides and all other galvanized components of the vehicle wash equipment shall be hot dipped galvanized.

## 2.11 VEHICLE WASH BAY MOBILE PLATFORM (V-10)

A. The contractor shall provide one (1) aluminum safety ladder to provide access to cleaning top of vehicles. Safety ladder shall be provided with spring loaded 2-inch ball bearing swivel brake casters and reinforced rubber tipped legs. Safety ladder shall be

made with 6061-T6 high strength aluminum alloy tubing and shall be unpainted aluminum mill finish. Safety ladder shall comply with OSHA 1910.29 and ANSI A14.7 standards with a 350-lb. load rating. Ladder shall have a top step height of 80-inches with an overall height of 110-inches and a base width and length of 30 inches (W) by 83 inches (L). Ladder shall have heavy duty aluminum grip strut steps. Safety ladder shall be as manufactured by Cotterman Company model NO. A8R2630, Ballymore Model No. ALWB830, or Uline Model No. H-7092.

## 2.12 PREFABRICATED TRENCH DRAINS

A. Prefabricated trench drains to be furnished by the General Contractor's vehicle wash subcontractor shall be Josam Pro-Plus 200 series or approved equal. Trench drains shall be 8” wide preformed polypropylene channels with 6 inch no hub drains. General Contractor shall provide appropriate quantity to provide continuously sloped system to drain outlets shown on the plumbing plans. General Contractor shall provide trench drains at minimum depth possible and shall provide 19.7” or 39.4” channel lengths as needed to achieve the layout shown on the drawings. Contractor shall refer to the plumbing drawings for connection to plumbing piping. The trench drains shall be installed by the Plumbing Contractor. The General Contractor shall modify the cast iron grates by drilling holes in strategic locations to match up with the undercarriage wash spray manifold nozzles. Grates shall be provided along the entire length of the trench drains. The General Contractor shall fabricate stainless steel vertical flanges that sit in the trenches to support the spray manifold off the bottom of the pre-sloped trench drains.

# PART 3 – EXECUTION

## 3.01 FACTORY TESTING

A. Prior to shipping from the factory, wash system shall be pre-assembled and full function tested prior to packaging and shipping to the job site. As part of the testing procedure, electrical panels, pump stations, and other applicable equipment shall be serialized and equipment shall be installed as a pre-tested system.

B. Test reports shall be provided with submittal documents verifying the factory test results.

## 3.02 SEQUENCE OF OPERATION

A. The automatic undercarriage/wheel wash system shall be provided with the following two modes: i. Automatic mode; and ii. Manual mode. Either mode shall be selectable at the toggle switch located on the vehicle wash bay wall located adjacent to the personnel door at the entrance end of the wash bay. Both automatic and manual mode sequence of operations shall function as described below:

1. **Automatic Mode**

1) A vehicle approaches the entrance to the wash bay and is detected by the loop detector.
2) The loop detector opens the overhead door and activates the photo eyes of the undercarriage wash system.
3) When the overhead door is fully opened, the traffic light located on the outside of the bay will turn green, signaling to the driver to proceed into the vehicle wash bay.
4) When the vehicle breaks the photo eye beam, the undercarriage wash will start spraying water.
5) When the photo eye beam is unbroken, a time delay for “spray off” will begin to allow the vehicle to finish driving over the undercarriage wash. When the time is up, the undercarriage wash will stop spraying water and the entrance overhead door will close behind the vehicle.
6) After the vehicle has passed through the undercarriage wash, the driver will exit the vehicle and proceed to wash the remainder of the vehicle manually using the wash wand and hose festoon system.
7) After the driver finishes washing the vehicle, the driver will open the overhead door by pushing the open button located adjacent to the overhead door.
8) The overhead door will be programmed (by the overhead door installer) to close on a time delay after the vehicle passes through the overhead door photo eyes.
9) If the overhead door is opened but the photo eyes are not broken (e.g. vehicle does not leave the bay) the overhead door will close automatically after 2 minutes.

B. **Manual Mode** will provide the following sequence of operation:

1) Vehicle approaches entrance to wash bay and parks in front of overhead door.
2) The driver will exit the vehicle and enter the wash bay through a personnel door. The driver will then open the overhead door using the open button located adjacent to the overhead door and will also push the "Start" button for the Automatic Undercarriage wash system located adjacent to the personnel door, which activates the undercarriage wash photo eyes and turns the traffic light green. (If the driver does not want the undercarriage wash to turn on, he would skip this step and the undercarriage wash would not turn on).
3) The driver gets back into the vehicle and proceeds into the wash bay.
4) When the vehicle breaks the photo eye beam, the undercarriage wash will start spraying water (only if photo eyes were activated in Step 2 above).
5) When the photo eye beam is unbroken, a time delay for “spray off” will begin to allow the vehicle to finish driving over the undercarriage wash. When the time is up, the undercarriage wash will stop spraying water. The overhead door will be shut on a time delay based on when the overhead door photo eye beam is unbroken. (the time delay for the overhead door shall be coordinated with the undercarriage wash time delay)
6) The driver would then park and exit the vehicle and proceeds to wash the remainder of the vehicle using the wash wand and hose festoon system.

7) After the driver finishes washing the vehicle, the driver will open the overhead door by pushing the open button located adjacent to the overhead door.
8) The overhead door will be programmed to close on a time delay after the vehicle passes through the overhead door photo eyes.
9) If the exit door is opened but the photo eyes are not broken (e.g. vehicle does not leave the bay) the overhead door will close automatically after 2 minutes.

## 3.03 INSTALLATION

A. Comply with manufacturer's written instructions, recommendations, and placement drawings.

B. Securely anchor equipment to floors and walls with manufacturer recommended anchors and fasteners.

C. Place freestanding equipment in final locations after finishes have been completed in each area.

D. Manufacturer shall provide an initial fill of all soap and solution tanks with the recommended brand of chemicals. Equipment supplier shall provide cleaning chemicals for start-up and training on the system, and for a period of 15 days from start-up at no additional cost to the Owner.

E. The manufacturer’s installer shall certify the subgrade piping/utilities prior to the concrete slab being poured, to ensure all subgrade utilities are satisfactory.

F. Water, power, and gas requirements of the wash system shall be supplied by Electrical and Plumbing Contractors. All other work shall be performed by the General Contractor, in order to provide a complete an operable system.

G. The vehicle wash manufacturer shall interlink the vehicle wash system with the wash bay ventilation system using low voltage wiring so that the ventilation system automatically turns on when the vehicle wash system is activated by the user. The ventilation system shall then run on a timed delay which can be adjusted by the Owner so that when the vehicle wash is deactivated in the vehicle wash bay, the ventilation system will continue to run for a length of time which can be set by the Owner. The vehicle wash equipment shall also be set to be shut off automatically after 30 minutes, if it is not in use. The vehicle wash shall also be linked in with the louver/fresh air ventilation system by the General Contractor using low voltage wiring and PVC or PVC coated galvanized rigid steel in accordance with NY and National electric codes for the wash equipment room and wash bay, so sufficient fresh air is being provided adequate to the vehicle wash and hot water system. The vehicle wash manufacturer shall provide all equipment necessary to control the activation/deactivation of the ventilation/louver equipment via low voltage wiring, including an adjustable time delay clock. The Mechanical Contractor shall provide the necessary ventilation/louver equipment and contact connections to the low voltage wiring to be provided by the vehicle wash manufacturer, in order to provide a complete and operable system.

## 3.04 MAINTENANCE SERVICE

A. Equipment supplier shall include monthly Preventative Maintenance (PM) service calls through the initial 1-year warranty period.

B. Normal wear items such as nozzles, fitting, small valves, hoses and hose clamps shall be included with the preventative maintenance service at no cost to the Owner.

C. A qualified service provider shall perform all maintenance items on the equipment as recommended by the equipment manufacturer.

D. Service reports shall be delivered to the Owner after each visit, documenting the service work checklist, and maintenance items that were performed.

## 3.05 FIELD QUALITY CONTROL

A. Field test each operational component of the vehicle washing equipment to verify proper operations in the presence of the Engineer.

## 3.06 TRAINING

A. Instruct Owner's personnel in proper use, operation, and daily maintenance of vehicle washing equipment.

B. Review emergency provisions, including procedures to be followed at time of operational failure. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete vehicle washing equipment maintenance program.

C. Make a final check of each vehicle washing equipment operation with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

D. Provide the Owner with a site specific written operation and maintenance manual (O&M), with instructions on how to use and maintain the equipment, with checklists indicating daily, weekly, monthly and annual maintenance tasks that need to be performed, including the monitoring and cleaning out of the trench drains and sumps. The O&M Plan shall take into consideration the entire vehicle wash bay system, such as the ventilation equipment, the plumbing/sub-grade tanks, discharge permit requirements, along with the vehicle wash equipment.

E. Provide operation and maintenance training on the equipment for the Owners personnel at the project site at no additional cost to the Owner. Provide at least 2-hours of training to the Owner.

END OF SECTION

SECTION 11 11 29

LUBRICATION DISPENSING SYSTEM

(ADD ALTERNATE 5)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENRAL CONDITIONS and all sections within DIVISION 01 -GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK:

A. This Section specifies the Fluid Dispensing System and is defined to include, but not necessarily limited to:

1. Furnishing and installing a complete waste fluid collection system and fluid distribution system at locations indicated on the Contract Drawings.
2. Acceptance testing.
3. Training of the Ardsley DPW personnel.
4. Maintenance of the system during the warranty period.

B. Furnish and install where shown on the Drawings all equipment, as specified, complete and ready for safe operation. Each item shall be specifically designed for the intended function. Provide necessary accessories, items of equipment, mechanical, electrical and structural items, whether specified or not in order to provide properly installed and functional equipment.

C. Equipment shall be suitable for installation in the space allocated on the Drawings and operation on the available building utilities. Any modification or redesign to the building structure or utilities because of an alternate equipment selection by the Contractor shall be provided by the Contractor at no additional cost to the Owner, and shall be as approved by the Engineer.

D. In all cases where a device or part of the equipment is referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

E. Related Work: the following items are not included in this section and will be performed under the designated Sections:

1. Division 22, PLUMBING
2. Division 26, ELECTRICAL

1.02 QUALITY ASSURANCE

A. Model numbers indicated are to establish a minimum standard of quality.

B. Work shall conform to Federal, State and local governing rules and regulations and ordinances, including OSHA and NFPA requirements, and shall pass inspection by the authorities having jurisdiction.

C. Work shall conform to State of New York Building Code, consisting of current versions of the following codes with all subsequent amendments:

1. International Building Code and Amendments as adopted.
2. International Plumbing Code.
3. National Electrical Code,
4. International Fire Code.
5. State Model Energy Conservation Code.
6. International Mechanical Code.

D. Furnish all materials and labor above and beyond those required by these specifications in order to meet these requirements and to obtain approvals of inspections and tests.

E. General:

1. All articles, materials, fittings, equipment and machinery incorporated in the work shall be new and unused, of recent manufacturer, free from defects and imperfections, and shall, as far as practicable, be manufacturer's standard make and shall be of first grade commercial quality, from reputable manufacturers, suitable for the purpose intended and subject to approval of the Engineer.
2. When two or more items of equipment are required, they shall be products of a single manufacturer.
3. All work shall be performed in a neat and workmanlike manner by workers skilled in their respective trades, and all materials and equipment shall be installed as recommended by the manufacturers and in accordance with specified codes and standards.
4. Touch-up or repaint to match original finishes, all factory finished or painted equipment and materials which are scratched or marred during shipment or installation.

F. Permits and Tests: The Contractor shall obtain necessary construction and/or operating permits from the State and other authorities having jurisdiction, make application and file all drawings required for such permits, and pay for all permits. Arrange for inspections and tests required by governing authorities and by the Owner and the State of New York, and pay all costs connected there with. Obtain and file

with the City and State written evidence that all the above requirements have been met. All permits will be in place (acknowledged in writing) and all testing will be complete prior to substantial completion.

G. Certificates:

1. Furnish an affidavit certifying that all materials and workmanship comply with the applicable code requirements.
2. Before final acceptance, furnish all required certificates of the authorities having jurisdiction.

H. Certificates of Compliance:

1. Upon delivery of the equipment, submit certificates of compliance. Each certificate shall be signed by an authorized representative of the manufacturer stating that the equipment and its installation comply in all respects with the Contract requirements.

F. General contractor shall be from a reputable firm able to demonstrate a minimum of five years' experience in pump sizing, installing and servicing fluid distribution system for vehicle maintenance applications.

G. The Contractor shall guarantee that the components furnished are compatible and that the completed system shall be satisfactory and operational in all locations.

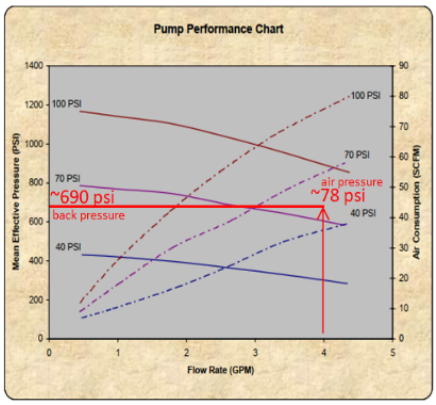
1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Submit shop drawings, catalog cuts and all manufacturers' data covering all equipment covered in this section.

B. General Contractor shall provide hydraulic calculations, and certification that all fluid distribution pumps are correctly sized for the systems back pressure in order to provide a complete and operable system. The general contractors fluid distribution sub contractor shall verify the equipment types/model numbers listed in this specification and shall modify them as needed to provide a complete and operable system. The general contractor shall certify that the lube system piping, valves, and other components are rated to the appropriate back pressure generated during system operation, to ensure a leak free system.

C. Hydraulic calculation shall include all equations, assumptions variables required to complete calculations including, but not limited to; pipe length, pipe diameter, flow rate, fluid viscosity at 65°F, number of fittings, elevation change, etc.

D. Pump performance charts shall be provided showing total system back pressure and air consumption on the y-axis and flow rate on the x-axis, with a redline mark up showing the approximate air pressure requirement for the proposed pump to deliver the specified fluids through the system at the design flow rate . See example mark up of a pump performance chart to the right.




E. The manufacturer shall submit a minimum of three locations where similar equipment has been provided and installed including date placed in service; provide contact information for people that are familiar with the project, and the name of the local service company that maintains replacement parts and provides warranty service.

1.05 JOB CONDITIONS

A. The Contractor's equipment and proposed materials shall be at least of the same level of quality as that indicated and specified.

B. Work includes furnishing and installation of heat actuated shut-off valves, shutoff valves, check valves, flexible hydraulic hose, distribution piping and fittings, fluid solenoid valves, fluid hose reel assemblies including support framing, control handles, pump systems, above ground tanks and all other work and material to provide an approved working installation as shown in the Drawings and as specified.

C. Unless otherwise specified, any materials described, shown, reasonably implied, or obviously a part of the system and necessary to its complete finish and perfect operation shall be furnished and installed, without extra charge. The Drawings and specifications are intended to supplement each other, and any item set forth in either shall be recognized as the same as if fully set forth in both.

D. The Contractor shall be responsible for coordinating all of the materials and equipment to provide a complete fully operational fluid dispensing system. Information provided on the Drawings and specifications are requirements to be used as guidelines to assist the Contractor and the lube system design engineer.

E. Where design information is not specifically noted on the Contract Drawings, it shall be the responsibility of the Contractor and the lube system design engineer to develop such design information as required by the manufacturer for a complete operational system.

F. The various component parts shall function together as a workable fluid dispensing system, complete with everything necessary for its operation and with all equipment properly adjusted and in working order.

G. Contractor shall provide complete maintenance and operation manuals for all of the fluid dispensing equipment under this section.

H. All components of the lubrications system shall be provided by a single source vendor to insure the Owner receives a complete and operable system.

1.06 WARRANTY

A. Following completion, the manufacturer shall provide the Owner with a one (1) year warranty minimum starting at project acceptance, covering all parts, materials, and labor. The lubrication pumps and reels will have a five (5) year manufacturer's warranty. Where equipment comes with longer warranty period, such as the pumps, the longer period shall be valid. All warranty work shall be performed by a local manufacturer's authorized distributer at the project location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment will be the responsibility of the Manufacturer.

B. Warranty: All equipment shall be warranted in accordance with the following provisions:

1. The Contractor warrants that the work performed, and all materials and equipment furnished hereunder by Contractor or their subcontractors or suppliers will be free from defects in design, material, workmanship and operation for a period of one years from the date of substantial completion except for special warranties as may be specified in the individual sections.
2. The Contractor shall remedy any such defect at his own expense.
3. The Contractor shall furnish written warranties, prior to final acceptance of the equipment item, required by the respective sections of the Specifications for time stipulated therein. These warranties shall be in writing, on the Contractor or supplier's letterhead and shall be included in the operations and maintenance manual(s) as specified elsewhere in this section.
4. Major equipment components, (as required by the respective sections of the specifications), specifically those manufactured by other than the primary equipment supplier, shall be covered by their own respective warranties, which shall not be less than the supplier's standard warranty. These warranties shall also be included in the operations and maintenance manual(s).
5. Nothing in these requirements, conditions or specifications including OWNER'S right to a complete inspection shall constitute a disclaimer or limit, negate, exclude or modify in any way any warranty created hereunder.

PART 2 – PRODUCTS

2.01 WASTE FLUID CADDIES (C-5A,C-5B)

A. Features and Construction for gravity portable drain pans for used oil and used anti-freeze.

1. Portable drain pan/waste collector, 26 gallon reservoir capacity with visual level gauge to indicate when drum is full with an 18 inch funnel diameter, transfer hose, and other accessories needed to provide a complete working system. Waste fluid caddies shall be compatible with waste fluid pump out stations (C-3 and C-6).
2. Drum colors: Black for waste engine oil, Green for Waste anti-freeze
3. Quantity: One (1) for waste oil and one (1) for waste antifreeze

B. Portable gravity drain pan/waste collector shall be Lincoln Model No. 3626 for waste oil and Model No. 3627 for waste anti-freeze, with all above accessories as required for a complete fluid recovery system as manufactured by Lincoln Industrial, Alemite, Graco or approved equal.

C. Funnel shall be Tamco Heavy Duty Square Funnels Model No. 78394 for waste oil and Model No. 78397 for waste anti-freeze, or approved equal. These shall be 12 in. square funnels with a 2 in. spout.

2.02 LOW PROFILE TRUCK OIL CADDY (C-2)

A. Provide one (1) waste fluid caddies Model No. 3665 as manufactured by Lincoln industrial or approved equal with the below minimum requirements.

a. Shall have a 6ft long discharge hose with a ¾ in camlock style connector and cap. The hose shall extend from the bottom of the reservoir and shall be able to connect to a diaphragm pump or other fluid transfer system to evacuate fluid from reservoir.

b. Shall have a 17 gallon capacity reservoir.

c. Made from lightweight high-impact polypropylene and mounted on four 4-inch diameter swivel casters.

d. Shall have an overall height of 7 ¾ inches and shall have a 20inch by 29inch reservoir with a removal metal screen that covers the resevior.

2.03 WALL MOUNTED PUMPS (C-15)

A. All fluid distribution pumps shall be designed for high fluid flow at medium pressure for large fleets, auto dealers, and construction equipment maintenance facilities. The following pumps for the listed fluids shall be furnished and installed by the General contractor:

1. One (1) 12:1 or 10:1 ratio wall mounted ball pump for 15W-40 Engine Oil
2. Two (2) 6:1 or 5:1 ratio wall mounted ball pump for Hydrauilic Fluid and ATF Note: Final pump ratios for each fluid type shall be determined by fluid distribution sub contractor based on final hydraulic calculation performed by the fluid distribution sub contractor. Hydraulic calculation shall be submitted for engineers review.

B. 12:1 Wall Mounted Ball Pumps for 15W-40 Engine Oil shall be Power Master Series III Model 2014 as manufactured by Lincoln industrial. Approved alternaitves are Alemite industrial oil pump model 7793-C (12:1) or Graco model Fireball 425 (10:1). The lube pumps shall have the following features and construction:

1. Air requirements: 69 scfm at 90 psi.
2. Six-inch stroke per cycle.
3. Air motor to allow for integrated automatic air shut off to prevent run away condition (with 6-inch diameter air motor).
4. Ball check seats with Grade 25 quality.
5. Integrated muffler to meet or exceed OSHA noise requirements.
6. Fully pneumatic, modular design, corrosion resistant air motor.
7. Pump tube to contain carbon steel plunger case hardened to depth of .010" with polyurethane seal arrangement.
8. Pumps will be 12:1 ratio
9. Pumps shall be wall mounted with all necessary mounting brackets
10. Hose or 2, pressure hose, air inlet hose filter regulator
11. Filter – Lincoln Model No. 600112
12. Regulator – Lincoln model No. 600012
13. Thermal relief valve (1,800 PSI max. allowable pressure)- Lincoln Model No.282876
14. Air supply hose – 5 feet minimum of ½-inch hose, Lincoln Model No.74060
15. Oil pressure hose - 5 feet minimum of ½-inch medium oil pressure hose Lincoln Model No. 73060
16. Anti-run on valve
17. Low level cut-off
18. Surge Suppression limited to 100-psi, and pressure relief valve

C. 6:1 Wall Mounted Ball Pump for Hydraulic Oil and ATF shall be Power Master Series III Model 2051 as manufactured by Lincoln industrial. Approved alternaitves are Alemite industrial oil pump model 7783-C4 (6:1) or Greco model Fireball 425 (6:1). The lube pumps shall have the following features and construction:

1. Air requirements: 20 scfm per cycle at 70 psi.
2. Six-inch stroke per cycle.
3. Air motor to allow for integrated automatic air shut off to prevent run away condition.
4. Ball check seats with Grade 25 quality.
5. Integrated muffler to meet or exceed OSHA noise requirements.

6. Fully pneumatic, modular design, corrosion resistant air motor.
7. Pump tube to contain carbon steel plunger case hardened to depth of .010" with polyurethane seal arrangement.
8. Pumps will be 6:1 ratio
9. Pumps shall be wall mounted with all necessary mounting brackets
10. Hose or 2, pressure hose, air inlet hose filter regulator
11. Filter – Lincoln Model No. 600108
12. Regulator – Lincoln model No. 600008
13. Thermal relief valve (900 PSI max. allowable pressure)- Lincoln Model No. 282876
14. Air supply hose – 5 feet minimum of ½-inch hose, Lincoln Model No.74060
15. Oil pressure hose – 5 feet minimum of ½-inch medium oil pressure hose Lincoln Model No. 73060
16. Low-level cut off -Lincoln Model No. 82439
17. Surge Suppression and pressure relief valve limited to 100 PSI.
18. Run away prevention/anti-run on prevention system.

2.04 REEL BANK (C-1)

A. Contractor shall provide one (1) reel bank supported from the ceiling. There are five (5) reels total. The reel bank shall be supplied with the following reels:

1. 15W-40 engine oil reel
2. Hydraulic oil reel
3. Automatic transmission fluid (ATF) reel
4. Electric Reel
5. Compressed Air Reel

B. Features shall conform to the following features and Construction for each fluid reel:

1. Heavy-duty lube reel.
2. Fifty (50) feet of ½"-I.D. Oil hose
3. Reel latch that automatically locks at desired position
4. Ball stop included
5. Maximum pressure: 1,500 psi
6. Material Inlet/Outlet: ½" NPTF(m)
7. Fluid distribution reel handles shall be properly installed to prevent leaking.
8. Reels shall be Product #8078-D with hoses for motor oil, hydraulic fluid, with all accessories as required for a complete reel system as manufactured by Alemite or approved equal.

C. Fluid reels shall come equipped with an Alemite 3671 electronic metered control valve or approved equal, as shown on the plans. All components to be verified by general contractors fluid distributions sub contractor, and modified as needed.

D. The compressed air reels shall conform to the following features and construction:

1. Standard.
2. Fifty (50) feet of 1/2”-I.D. air hose
3. Reel latch that automatically locks at desired position
4. Air chuck (Attachment for tires) Lincoln Model No. 66951 hand held meter
5. Ball stop included
6. Maximum pressure: 350 psi
7. Material Inlet/Outlet: 1/2”NPT (female)
8. Sheave width: 4-1/2 inches
9. Sheave diameter: 19-1/2 inches
10. Drum Diameter: 12-5/8 inches
11. Overall width: 6-5/8 inches
12. Overall Height: 23-3/4 inches
13. Overall Depth: 19-3/4 inches
14. Air compressor reels shall be Alemite Model 8078-M for air with all accessories as required for a complete air compressor reel system as manufactured by Lincoln Industrial, St. Louis, MO; Alemite or Graco.

E. The electrical reel shall conform to the following features and construction:

1. 45 ft. cord length.
2. 12 guage cord size
3. Electric reel shall be rated for 115v 20amps with a duplex GFCI receptacle mounted at the end of the cord reel
4. Electrical reels shall be Model No. 7260 as manufactured by Alemite; Lincoln Industrial, Graco or approved equal with the above minimum requirements.

2.05 WASTE FLUID PUMP EVACUATION SYSTEM (C-3, C-6)

. Two (2) pumps required:

1. Provide one (1) wall-mounted waste oil pump evacuation systems for evacuating waste oil from rolling drain pans and oil filter drain box, and deliver waste oil by overhead piping to the Waste Oil Storage Tank inside the Fluid Storage Room. See Drawings for pump locations.

2. Provide one (1) wall-mounted waste anti-freeze pump evacuation systems for evacuating waste antifreeze from rolling drain pans and deliver waste anti-freeze by overhead piping to the Waste anti-freeze storage tank. See Drawings for pump locations.

B. Features and Construction for each waste fluid evacuation system:

1. Wall-mounted pump: material hose on input side of pump shall be equipped with removable quick connect fluid connector on the input end that is compatible with coupler on the rolling drain pan collector unit. A second removable open fitting shall also be provided that can be easily installed by the Owner to draw used oil out of an open container.
2. Power Factor: 1:1 ratio
3. Suction Kit
4. Air requirements: 60-120 psi
5. Air Hose: Rated for 175 PSI minimum air pressure
6. Fluid Hose: Rated for proper pressure – 1800 psi, ½-inch
7. Hose and Fitting Kit
8. Low level cut-off
9. Provide air filter, air regulator and gauge, water separator, drain port, and lubricator for airline connection
10. Runaway valve
11. 150-psi Pressure Relief Valve
12. Ball-type shut-off valves
13. Surge Suppression limited to 100-psi
14. Provide bushings as necessary for motor to hose connection
15. Bare stub

C. The waste fluid pumps shall be Model No. 4100 1-inch UL diaphragm provided with complete pump kit and all above accessories and other appurtenances as required for a complete waste fluid pump evacuation system as manufactured by Lincoln Industrial, St. Louis, MO; Samson, or Graco.

## 2.06 OIL TROLLEY (C-16)

A. Contractor shall furnish two oil trolley's that can dispense either 5W-20 or 5W-30 motor oil and conforms to the following features and construction:
1. Trolley shall be designed to hold a 55 gallon drum and provide space to mount a hose reel.
2. Trolley shall have pivoting back wheels
3. Lube trolley shall be provided with
   i. 3:1 Pneumatic oil pump and downtube for 55 gallon drums
   ii. heavy duty hose reel that can store a min of 35ft of delivery hose
   iii. 5ft long suction hose

iv. Electronic meter with flexible extension nozzle that can measures pints, quarts, gallons or liter.
v. Air control with filter/regulator/gauge

4. Lube trolley package shall be as manufactured by Alemite model 343509, or approved equal.

2.07 SERVICE LABELS

A. Provide metal labels for all of the service reels and pumps included in these specifications. Include a label for each reel.

B. Labels will be metal labels, 3-1/4 inch wide x 4-1/4 inch long minimum with preprinted label.

C. Provide all mounting hardware to mount all labels on pumps and reels.

D. Service labels shall be as manufactured by Lincoln Industrial, St. Louis, MO; or approved equal, with the above minimum requirements.

2.08 REEL SUPPORT FRAMING

A. Reel supplier shall be responsible for furnishing appropriate framing for the hanging of the overhead reels from the building structure. Reel support framing will begin at the bottom of the framing steel reel supports as shown on the drawings. Threaded rod hangers will not be allowed.

B. All materials required to affix the frame to the building structure and the reels to the frame are the responsibility of the reel supplier.

2.09 FLUID DISPENSING PIPING

A. All fluid main and branch line piping shall be seamless stainless steel tubing with seamless steel Swagelok type compression fittings. The contractor shall size the piping based on hydraulic calculations used for sizing the fluid distribution pumps. Steel tubing shall be installed in accordance with manufacturer's recommendations.

B. The General Contractor shall provide stainless steel piping/fittings and valves rated for the appropriate back pressure developed during fluid pumping activities.

C. The General Contractor shall also provide an electronic motorized ball valve controlled by an adjustable electronic timer at a location 4 feet above the floor as shown on the Plumbing and Electrical Drawings. The Plumbing Contractor shall install the motorized ball valve and the Electrical Contractor shall provide power to the ball valve and the time clock, Electrical Contractor shall also install the Time Clock. The motorized ball valve shall be Watts Model LFEMVII – 6400-SS or equal, sized to fit the airline shown on the Plumbing Drawings and the time clock

shall be Omega Model PTC-15 or equal. The Owner shall be able to adjust the time on the time clock so that the air supply to all lube system pumps in the fluid storage room is shut-off automatically at the time selected by the Owner. The timer shall also open the valve automatically at a pre-set time, and shall be equipped with a manual over-ride.

D. One Heat-actuated shut-off valve shall be located on the main air supply line in the fluid storage room feeding all of the air operated pumps at a point 4 feet above the finished floor. The General contractor shall provide the heat actuated shut off valve and the Plumbing Contractor shall install the valve. Heat actuated shut-off valve shall be as follows:

1. Spring-loaded seat disc open position maintained by a fusible link. Valve shuts at 212 degrees F temperature to shutdown lines carrying flammable fluids. Body material shall be bronze. Maximum pressure rating shall be 300 psi. Valve shall have a 212 degrees F fusible link. Acceptable manufacturers are Cashco FL Series, or approved equal by Assured Automation or, Valtorc.

E. All piping shall be security fastened so as to prevent shaving and potential leaks and movement. Pipe may be hung/secured using threaded rod provided the total length of threaded rod does not exceed 2-inches, unless otherwise approved by the Engineer, to prevent pipe swaying/movement. Piping shall be secured in accordance with manufacturers recommendations.

F. The waste oil pipe shall be run tight to the structure including the ceiling and walls. The pipe shall not be allowed to run from the ceiling down to a lower mezzanine level without the support of a permanent wall. All structure penetrations shall be sealed to maintain wall/ceiling assembly fire rating.

## 2.10 FLUID DISPENSING PIPING IDENTIFICATION

A. Provide pipe markers on all fluid dispensing piping in accordance with ANSI A 13.1 standards.

B. Pipe markers to be: Seton Opti-Code; material indicator on pressure-sensitive vinyl sheet with Seton Arrows-On-A-Roll; direction-of-flow arrows.

C. Provide identification of all piping with heating tape concealed on top the insulation so that it is easily visible.

D. Pipe markers shall be as manufactured by Seton Identification Products; Brady Corporation; Champion America, Inc; or approved equal, with the above minimum requirements.

E. Contactor shall install pipe markers per manufacturer's installation recommendations.

## 2.11 VALVES

A. Valves shall be ball type or other approved equal, and shall be specified by the lube system design engineer, and shall be rated for the appropriate back pressure.

## 2.12 PIPE SUPPORT

A. Products of Grinnel, Superstrut, B-Line, and PHD Manufacturing or approved equal will be accepted. Hangers, supports and accessories used shall be applied in accordance with the manufacturer's recommendation for type of service and application. All supports, rods and accessories shall be galvanized.

## 2.13 WASTE FLUID STORAGE TANK & FLUID ROOM SUMP ALARMS (C-4,C-7,C-14)

A. Waste Fluid Tank Alarm (C-4 & C-7): Contractor shall furnish and install a new tank alarm at each new waste fluid pump out station (C-4 and C-7) as indicated on the drawings. The waste fluid tank alarm shall tie into the tanks high level floats in accordance with manufacturer recommendations. Provide compressed air line automatic shut-off system, which consists of an electrically operated valve tied into the waste fluid tank alarm. This system will serve to shut air off to the existing waste fluid pumps when the fluid level reaches 90% of the tank capacity. The system shall be installed in accordance with the lube system manufacturer recommendations. The Contractor shall provide the ne1cessary equipment, materials, and wiring, in accordance with the lube system contractor/manufacturer recommendations in order to provide a complete and operable system.

B. Fluid Storage Room Sump Alarm (C-14): The sump alarm shall come equipped with a liquid sensor which shall be mounted in the sump per manufacture recommendations. The liquid sensor shall be as manufactured by Gems Sensors model LS-10, or approved equal. The Electrical Contractor shall provide an empty conduit with a pull string running from the sump alarm down to the bottom of the fluid storage room sump, as shown on the electrical drawings. The fluid storage room sump alarm shall be tied into the building fire alarm control panel, to automatically notify the fire department in the event that a leak has accorded in the fluid storage room.

C. The tank alarms and fluid storage room sump alarm shall be Model TA-732 as manufactured by Warrick Controls; Omntec, OPW or approved equal and shall conform to the following requirements:

1. Unit shall be intrinsically safe.
2. Unit shall be equipped with auxiliary contact for remote annunciation or cutoff.
3. Unit shall be equipped with two channels
4. Unit shall be equipped with two conduit connection hubs.

5. Unit sound level shall be adjustable from 77 to 97 dB at 2-feet
6. Unit shall have red LED indicating a fault condition.
7. Unit shall have a yellow LED indicating fault condition has occurred even if fault has cleared itself.
8. Unit shall have green LED indicating unit has power.
9. Unit shall be equipped with an acknowledgement button allowing direct alarm silencing.
10. Unit shall be equipped with a test button to allow alarm activation and system testing.
11. Supply Voltage: 120 VAC +10%/-15%, 6.6 VA Max
12. Indicators: Red, Green, and Yellow solid state LED
13. Enclosure: NEMA 4x
14. Sensor Voltage: 12 VAC or 12 VDC
15. Terminals: size 6 pan head screws with captive wire clamping plate
16. Temperature: -22 F to +150 F
17. Sensitivity: 0-26K Ohm Maximum specific resistance
18. Maximum Wire Run: 1000 feet (14 or 16 gauge MTW or THHN wire)
19. Conduit Connection: ¾-inch FNPT
20. Interface Contacts: Normally open dry (sensor normally dry)
21. All alarm wiring shall be installed within galvanized steel rigid conduit
22. Alarm shall be electrically hard wired. Alarms equipped with plugs are not acceptable.

## 2.14 TANK FLOATS AND SENSORS

B. Contractor shall furnish and install two (2) tank monitoring level floats, one for each compartment of the waste fluid tank (C-13) as shown on the equipment drawings.

5. Tank level float shall be compatible with the TA-732-A-O alarm panel.
6. Float should be single pole double throw switch, normally open dry type.
7. Tank level float shall be Model No. LS-800 as manufactured by Gem Sensors and Controls, Plainville, CT, Warrick Controls or other approved equal.
8. Level Float shall be a single level monitoring float.
9. Float shall be U.L. listed and intrinsically safe to operate in a Class I Hazard Area.
10. Stem shall be 316 stainless steel.
11. Stem length shall be determined by the float manufacturer and shall be in accordance with the tank and lubrication manufacturers.

12. Float material shall be 316 stainless steel and shall be compatible with the associated fluids.
13. Float shall have 2-inch NPT mounting fitting compatible for direct installation with the tanks specified.
14. Float stops shall be set to cut the air supply to the waste pumps and trigger the high level alarm at 90% capacity of the tank.
15. Floats stops and appurtenances shall be 316 stainless steel.
16. All float/alarm wiring shall be installed within galvanized rigid steel conduit.

C. The Contractor shall provide the necessary equipment, materials, and wiring, in accordance with the lube system manufacturer recommendations in order to provide a complete and operable system.

## 2.15 FLUID STORAGE TANKS (C-12, C-13)

A. Contractor shall provide the following two (2) double wall fluid storage tanks:

1. C-12: 300 gal Fluid Split Tank (100 gal ATF, 100 gal 15W-40, 100 gal Hydraulic Fluid)
2. C-13: 400 gal Waste Fluid Split Tank (300 gal waste oil, 100 gal waste antifreeze)

B. Features and Construction for tanks:

1. Material: double-walled steel

2. Meet NFPA and UL-142 requirements

3. Lifting lugs

4. Tank openings (minimum requirements per tank compartment for split tanks):

   i. 1 - 2-inch spares
   ii. 1 - 2-inch fill
   iii. 1 - 2-inch discharge/pump-out assembly
   iv. 1 - 2-inch working vent
   v. 1 - 2-inch mechanical gauge/spare
   vi. 1 - 4-inch primary tank emergency vent
   vii. 1 – 6-inch secondary containment emergency vent
   viii. 1 – 2-inch secondary containment monitoring port
   ix. 1 – 2-inch monitoring port/spare
   x. 1 – 2-inch secondary working vent

C. The oil storage tanks shall be Lube Cube with all above accessories as required for the oil storage tanks as manufactured by Containment Solutions, Inc.; Highland Tank, Turner Tanks or approved equal.

D. The Plumbing contractor shall vent the tanks up through the roof to the locations shown on the drawings. The discharge/pump out assembly shall consist of a 2-inch diameter drop tube, Model No. 723; a 2-inch cam-and-groove coupling adapter, Model No. 49-C; and a socket type coupling cap, Model No. 49-CAP as manufactured by Universal Valve Company or approved equal.

E. Each compartment shall be equipped with a visual level gauges in accordance with manufacturer's recommendations. The visual level gauges shall have the following:

1. 2-inch male NPT threads
2. 301 Stainless steel rods
3. Lexan lens cover
4. Polypropylene and aluminum float
5. Leak guard shall be as manufactured by Morrison Bros Model 718 or approved equal by Husky Red Fox Guage or approved equal.

F. The interstitial space of the ASTs shall be monitored using a leak guard sight glass guage for double walled tanks.The leak guard shall have the following:

1. 2-inch NPT tank fitting
2. Stainless steel rods
3. Aluminum linkage
4. Nitrophyl float
5. Leak guard shall be as manufactured by BJE Model Jarhead or approved equal by Kreuger Sentry Guage.

G. General contractor shall provide five (5) overfill prevention valves, one for each fluid storage tank compartment. Overfill prevention valves shall be as manufactured by manufactured by Universal Valve Company Model No. 47-20 or approved equal.

H. Tanks shall be painted per manufacturer recommendations and color shall be chosen by the Owner.

## 2.16 OIL FILTER DRAIN BOX (C-8)

A. Contractor shall provide a waste oil filter drain box as manufactured by Safe T Tank of Meriden CT, Turner Tanks, Highland Tanks or equal. The filter drain box shall be approximately 2 feet X 2 feet square in plan and 2.5 feet deep, and shall be supported on four steel legs for a total height of about 3.5 feet, see below for determining final height. The drain box shall be constructed of heavy gauge steel as

recommended by the manufacturer and equipped with a heavy duty steel screen located approximately six inches from the bottom of the box to allow the filters to freely drain into the bottom of the container.

B. The box shall have a hinged steel lid so that it can be easily opened and closed and shall be able to safely store approximately 15 gallons of oil beneath the filter screen. The bottom of the box shall be equipped with a 1-inch waste oil pump out steel tube with a manual shut off valve, and quick disconnect fitting that will allow the oil to be easily connected to the waste oil pump described herein, in a leak free manner, so that waste oil can be easily pumped to the waste oil tank located in the fluid storage room. The end of the steel tube shall be positioned above the top of the box to prevent leaks, coordinate with the Engineer in advance.

C. All components of the box shall be primed and painted in accordance with manufacturer's recommendations in order to provide a corrosion proof durable finish suitable for its intended use. The Owner shall choose the paint color.

D. The contractor shall provide all other equipment, materials, and labor necessary in order to provide a complete and operable waste oil filter drain, containment and waste oil pumping system.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance, with approved shop drawings and manufacturer's installation instructions at locations indicated in Drawings.

B. Coordinate installation of the fluid reels at the bays and the pumps supplying service located in the Fluid Storage Room with Drawings and Specifications. Make and provide all connections for proper operation.

C. The pumps shall supply product to all reels at locations shown on Drawings.

D. Provide mounting channels and brackets and structural supports (where required) as recommended by manufacturer for reel bank support and connection. Mounting heights as indicated in the drawings. Provide required bracket for such installation, see Structural Drawings for reel bank support framing.

1. Contractor to use mounting channels appropriate for each reel installation as provided by Lincoln Industrial or approved equal. Provide connections as required to work in conjunction with structural supports.

E. Fluid dispensing equipment shall deliver an acceptable amount of fluid as recommended by Owner, with a minimum flow of 2 GPM for motor oils and 1 gpm for the automatic transmission fluid reel. The waste oil pump system shall pump waste oil at a minimum flow of 5 GPM to the waste oil tank in the fluid storage room.

F. The Contractor shall provide all air line connections with required air filter, regulator and valves and other appurtenances as needed, as recommended by the lube system design engineer.

D. Fluid distributor reel handles shall be installed properly to prevent leaking.

E. Note all pumps shall be mounted on the wall above the tanks/drums in order to prevent excessive product leakage in the event of pump failure.

F. The Owner shall provide the fluid drums for the system.

3.02 FIELD QUALITY CONTROL

A. Provide the services of qualified manufacturer's representatives to perform the following:

1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Coordinate, prior to installation, the mounting requirements of the fluid pumps to the tanks to assure that proper hardware has been provided.
4. Provide shut-off valves at a convenient visible location for emergency shut-off of fluid lines and at each reel for individual service.
5. Prior to substantial completion of the facility, supervise testing, by the Contractor in the presence of the Engineer, to ensure proper operation of the equipment.
6. Instruct Owner's personnel in the proper safe operation and maintenance of the equipment.
7. Perform all scheduled and unscheduled maintenance during warranty period; provide all labor and materials.

3.03 EQUIPMENT TEST AND CHECK-OUT

A. Before Substantial Completion, the Contractor-furnished equipment shall be tested in the presence of the Engineer to his satisfaction and demonstrated to be correctly connected and installed. Submit a testing schedule to the Engineer for approval prior to the start of the equipment test and check-out.

B. Testing and check-out procedures of the manufacturer shall be carried out completely.

C. The Owner will provide vehicles and vehicle components to be used during the testing procedures as required by the Contractor and approved by the Engineer.

D. Equipment tests shall not only be performed to demonstrate that the equipment has been properly installed and connected and operates properly but also to demonstrate that the equipment performs the work for which it is intended.

E. Tested equipment found to be defective or inoperable to any extent shall be reported to the Engineer immediately.

F. Any operating difficulty or defective item shall be repaired or replaced and put into proper operation by the Contractor immediately, at no additional expense to the Owner.

G. Protect equipment and surrounding areas from damage resulting from testing operations. Clean-up spills or leakage from testing.

H. The Contractor shall bear all expenses of all tests, including the furnishing of all necessary instruments, lubricants, hydraulic fluid, supplies, data recorders, and operation personnel, Provide and bear all expenses for fuel/power required to operate the equipment during the tests.

I. At the sole discretion of the Engineer, the Contractor may be required by repeat any tests, at no cost to the Owner.

3.04 TRAINING PROGRAM

A. General Requirements: The Contractor is responsible for training the Owner's personnel.

1. Maintenance management classes are to take place prior to substantial completion of the facility.
2. Mechanics training will commence only after installation of system is complete at the garage.
3. Training Shall be conducted at the new Maintenance Facility.
4. Hours for training are to be between 9:00 a.m. and 5:00 p.m. unless specifically permitted otherwise

END OF SECTION

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SECTION 11 31 00

APPLIANCES

## PART 1 - GENERAL

1.01 SUMMARY

A. Provide residential appliances, including the following:

1. Electric cooktops.
2. Microwave ovens.
3. Refrigerator/freezers.
4. Dishwashers.

1.02 RELATED REQUIREMENTS

A. Division 22 – PLUMBING: Water connections.

B. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:

1. Exhaust ducts to clothes dryers, (including connections).

C. Division 26 - ELECTRICAL: Electrical supply to appliances.

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder clearly indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.
2. Manufacturer’s installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
3. Manufacturer’s certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
4. Manufacturer's sample warranties.
5. Shop drawings for coordination: Provide dimensioned locations for utility connections.

B. Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT:

1. Manufacturer’s warranties: Include coverage of installed equipment.
2. Maintenance Data: Include lubrication and periodic maintenance requirement schedules.

1.04 REGULATORY REQUIREMENTS

A. Ensure that Owner furnished products requiring electrical connections are Listed and classified by UL, as suitable for the purpose specified and indicated.

B. Install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.

1.05 QUALITY ASSURANCE

A. Certification labels: Provide residential equipment which complies with standards and bears certification labels as follows:

1. Energy ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and energy information as required by Federal Trade Commission.
2. UL standards: Provide residential equipment with UL labels.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store all products in original packaging in protected interior location.

B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows or doors to place and install the work of this Section shall be performed at not additional cost to the Owner.

1.07 WARRANTY

A. Provide manufacturer's standard warranties under the provisions of Section 01 78 00 – PROJECT CLOSEOUT.

**PART 2 – PRODUCTS**

2.01 MANUFACTURERS

A. General: Provide products of same manufacturer for each type of residential appliance required. To greatest extent possible, provide equipment by single manufacturer for entire project.

1. In kitchens, provide appliances with matching color and style. When equipment is by more than one manufacturer, provide units matching

B. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on companies listed under the Article "Equipment".

C. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Frigidaire Corp./ Division of Electrolux Home Products Inc., Martinez, GA.
2. General Electric Company, (GE) Appliances Division, Louisville KY.,
3. KitchenAid Company (division of Whirlpool Corp), St. Joseph, MI.
4. Maytag Company, Magic Chef Division, Cleveland TN.
5. Panasonic Company, Secaucus NJ.
6. Whirlpool Corporation, Benton Harbor MI.
7. Samsung

2.02 EQUIPMENT

A. Microwave Oven: Above the cooktop type, LED controls, 10 power levels.

1. Capacity: 2.1 cubic feet.
2. Exhaust rating: 400 cubic feet per minute.
3. Basis of Design: General Electric model Nº. PVM9005SJSS or approved equal.

B. Refrigerator/Freezer: 25 cu. ft. French Door Refrigerator in Fingerprint-Resistant Stainless Steel

1. (2) French Door Refrigerators with water and ice dispenser and bottom freezer.
2. Basis of Design: Whirlpool model Nº. WRF555SDFZ or approved equal.
3. Color: Stainless Steel

C. Cooktop: 30 inch built-in electric cooktop, front-center glide touch controls.

1. Cooktop surface: Glass ceramic.
2. Basis of Design: General Electric model Nº. CP9530SJSS or approved equal.
3. Color: Flagstone gray.

D. Dishwasher: 30 inch built-in electric cooktop, front-center glide touch controls.

1. Controls: Hidden.
2. Basis of Design: General Electric model Nº. PDT845SSJSS or approved equal.
3. Color: Stainless.

E. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.

2.03 FINISHES

A. Finish Colors: Provide manufacturer's standard colors as selected by Engineer.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Engineer, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.

B. Verify clearances required for equipment.

C. Verify ventilation outlets, service connections, and supports are correct and in required location.

D. Verify that electric power is available and of the correct characteristics.

E. Beginning of installation means acceptance of existing site conditions.

3.02 INSTALLATION

A. Install each product in accordance with manufacturers' instructions.

1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.

B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 73 00 - EXECUTION.

B. Adjust equipment to ensure proper working order and conditions.

C. Remove and replace equipment creating excessive noise, or vibration.

D. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches as required. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.04 CLEANING

A. At completion of each work day, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.

B. Upon completion of the work of this Section, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.

C. Clean Work under provisions of Section 01 74 13 – CLEANING UP:

1. Wash and clean appliances.
2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.

D. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

END OF SECTION

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SECTION 12 24 00

WINDOW SHADES

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Chain driven, manually operated roller-screens for solar shading and privacy.
2. Supplementary items required for shade installation.
3. Provide window shades at all interior offices and conference rooms.
4. Provide window shade at all exterior storefront windows except for entry vestibule.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - ROUGH CARPENTRY: Blocking for window shades.

B. Section 08 43 13 – ALUMINUM-FRAMED STOREFRONTS.

C. Section 08 51 13 – ALUMINUM WINDOWS.

D. Section 09 29 00 - GYPSUM BOARD: Substrate for window shade systems.

E. Section 09 51 00 - ACOUSTICAL CEILINGS: Relationship of window shades to acoustical ceilings.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. NFPA 701 - Standard Methods of Fire Tests for Flame-resistance Textiles and Films.
2. UL 214 - Standard for Tests for Flame Propagation of Fabrics and Films.

1.04 PERFORMANCE REQUIREMENTS

A. Fire performance characteristics; shade material tested in accordance with NFPA 70 1- Vertical Burn Test, rated “FR”.

1.05 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    a. Provide additional information required for fabric, including: Size limitations, fire resistance information. Identify available shade cloth colors and materials.
    b. Note on submittals any deviations from specified requirements and the reasons thereof.
2. Maintenance Information: Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
3. Warranty: Provide sample 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.
4. Certifications:
    a. Manufacturer shall submit notarized certificate indicating compliance with requirements of specifications and that specified warranty will be provided without restriction.
    b. Certification of compliance with current building code and environmental regulations: Manufacturer shall certify that materials proposed for use comply with applicable building code and environmental regulations.
    c. Authorization for Deviations From Specifications: If any deviations from specifications have been accepted, include written description and reasons for deviations. Include authorization for change signed by Owner, Engineer, Engineer, and person submitting change. Authorization for change shall also clearly indicate party responsible for remedying defects.
5. Shop drawings:
    a. Dimensioned 1/4 inch scale drawings, bearing dimensions of actual measurements taken at the project, where practical.
    b. Include complete fabrication details and erection drawings.
6. Selection Samples:
    a. 3 by 5 inch size shade cloth and liner sample swatches indicating Manufacturer's full range of colors and patterns available for initial selection.
    b. Provide additional shade cloth and liner samples, of size requested by Engineer, to aid in the Engineer’s selection.
7. Verification Samples:
    a. 12 by 12 inch samples of blind fabric illustrating material and color.
    b. 12 inch lengths of roller assembly.

1.06 QUALITY ASSURANCE

A. Obtain shade operators and fabric products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of operator.

B. Notify the Engineer where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.07 QUALIFICATIONS

A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.08 DELIVERY, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Do not deliver shades to the project until all concrete, masonry, plaster and other wet work has been completed and is dry.

C. Deliver prefabricated shades to site in labeled protective packages, uniquely identified for each intended location. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.

D. Store materials in manner recommended by shade manufacturer, inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

E. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of window shades, and maintain until Owner's Final Acceptance.

1.09 FIELD MEASUREMENTS

A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 WARRANTY

A. Furnish the following warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.

1. Manual operating components: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provisions that installation shall remain operational without fault and include all operating parts, except for the bead chain which is not warranted.
2. Shade cloth: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provision that shade cloth will not fade, deteriorate, sag or warp for the warranty period.

1.12 EXTRA MATERIALS

A. Provide to Owner, 1 percent extra shade fabric for each size, color and type installed.

**PART 2 – PRODUCTS**

2.01 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on MechoShade, Long Island City, NY.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:

1. MechoShade, Long Island City, NY.
2. Draper Shade and Screen Co., Spiceland, IN.
3. Levolar Corporation, Sunnyvale, CA.

2.02 SHADE COMPONENTS

A. Clutch operator: Bi-directional clutch and beaded chain mechanism, fabricated from high-strength glass-fiber -reinforced polyester and high-carbon steel springs. Control loop chain shall endless nickel-plated brass bead chain; plastic bead chain is not acceptable.

1. Furnish flexible offset drive, where required, with universal joint permitting up to 12 degree angle between any two shades with a single operator.
2. Provide all shades with chain hold down, spring-tension pulley and shock absorber.

B. Rollers: Removable, 1-1/2 inch or larger diameter, extruded aluminum alloy 6063-T5 or alloy 6063-T6 tube with a minimum wall thickness of 0.065 inch.

1. Shade mounting spline: Extruded vinyl spline, enabling shade cloth to be removed without having to remove the tube from retainer brackets or without removing brackets from wall
2. Tube Support: Delrin cover plate shall provide protection from tube dislocation. In the event the tube is pushed out of place, the Delrin end of the mounting plates shall contain the tube preventing the tube from falling out of the bracket.

C. Mounting Brackets: Zinc chromate finished 16 gage steel in manufacturer's standard configuration for head or wall mounting.

D. Roller idler assembly: Type 6/6 injected molded nylon or high-strength glass-fiber - reinforced polyester outside sleeve, with zinc plated steel pin.

E. Fabric - General: Basket-weave dense uniform-scrim shade cloth having 0 percent, 3 percent, 5 percent or 10 percent openness factor depending on room function and orientation. Supplier to review building plans and site orientation with Owner to determine best fabric type for each room.

1. Black Out Fabric: PVC-free, Glass-fiber yarn coated with opaque acrylic backing comprising of 34% fiberglass, 66% acrylic coating, equal to MechoShade "Equinox 0100 Series" meeting the following minimal requirements:
   a. Openness factor: 0 percent, opaque.
   b. Minimum weight: 0.94 pounds per square yard.
   c. Seamless up to 98 inch width (249 cm).
   d. Flame retardant treated certified in conformance with NFPA 701.
   e. Color: As selected by Architect from manufacturer's standard colors.
   f. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
   g. Fabric warranty: Manufacturer's standard 10 year limited warranty.
2. Solar /Privacy Fabric: Equal to MechoShade ThermoVeil, 1500 series, fabricated from polyester yarn with a PVC coating, woven in a non-directional basket-weave, meeting the following minimal requirements:
   a. Openness factor: 3 percent.
   b. Color: As selected by Architect from manufacturer's standard colors.
   c. Fading:
   d. UV test 200 sun-fade hours: No change.
   e. UV test 500 sun-fade hours: Maximum 5 percent change.
   f. Seamless up to 126 inch width.
   g. Flame retardant treated certified in conformance with NFPA 701, UL 214.
   h. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.

i. Fabric warranty: Manufacturer's standard 10 year limited warranty.

3. Solar /Privacy Fabric: Equal to MechoShade ThermoVeil, 1300 series, fabricated from polyester yarn with a PVC coating, woven in a non-directional basket-weave, meeting the following minimal requirements:
   a. Openness factor: 5 percent.
   b. Color: As selected by Architect from manufacturer's standard colors.
   c. Fading:
   d. UV test 200 sun-fade hours: No change.
   e. UV test 500 sun-fade hours: Maximum 5 percent change.
   f. Seamless up to 126 inch width.
   g. Flame retardant treated certified in conformance with NFPA 701, UL 214.
   h. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
   i. Fabric warranty: Manufacturer's standard 10 year limited warranty.
4. Solar /Privacy Fabric: Equal to MechoShade ThermoVeil, 2100 series, fabricated from polyester yarn with a PVC coating, woven in a non-directional basket-weave, meeting the following minimal requirements:
   a. Openness factor: 10 percent.
   b. Color: As selected by Architect from manufacturer's standard colors.
   c. Fading:
   d. UV test 200 sun-fade hours: No change.
   e. UV test 500 sun-fade hours: Maximum 5 percent change.
   f. Seamless up to 126 inch width.
   g. Flame retardant treated certified in conformance with NFPA 701, UL 214.
   h. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
   i. Fabric warranty: Manufacturer's standard 10 year limited warranty.

## 2.03 MOUNTING SYSTEM

A. Mounting: Wall, jamb, or overhead mounted as indicated, brackets made of 1/8 inch sheet steel to which drive assembly, idle end assembly and center support systems are attached.
   1. Furnish center support brackets to meet span or weight requirements.
   2. Components of brackets shall be interchangeable or replaced without removing bracket from wall or ceiling, inside or outside mount.
   3. Metal support brackets cadmium plated steel. Custom color as selected by the Engineer.

2.04 ACCESSORIES

A. Fascia: One-piece extruded aluminum 6063-T5 alloy with average thickness of 0.062 inches, snap-loc clipped to the brackets without the use of glue, magnetic strip or screws, concealed fastening.

1. Offset Drive - No Notch Fascia: Chain drive shall fall behind the return edge of the fascia without notching or otherwise defacing the return leg of the fascia.
2. Fascia filler; readily removable to bridge mullions, transition piece between shades in same material and finish as fascia panel.

B. Recessed housing, for gypsum board ceilings with removable closure plate for access.

C. Guide cables provide where recommended by manufacturer.

2.05 FABRICATION

A. Fabrication: Fabricate units to completely fill existing openings, from head-to-sill and jamb-to-jamb. Do not commence fabrication of shade units until field measurements are confirmed.

B. Fabric shall hang straight and flat without buckling or distortion. Fabric edges shall be straight and without ravels.

2.06 FACTORY FINISHES

A. Aluminum: PPG Duracron baked enamel in standard colors.

B. Steel parts, cadmium plated, satin finished, or bonderized prior to painting with baked enamel finish.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Ensure that supporting substrate is adequate.

B. Beginning of installation means acceptance of existing project conditions.

3.02 INSTALLATION

A. Install units to comply with manufacturer's instructions for type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

3.03 TOLERANCES

A. Maximum variation of gap at window opening perimeter: 1/4 inch.

B. Maximum offset from level: 1/8 inch.

3.04 ADJUSTING

A. Adjust units for smooth operation. Replace any units or components which do not operate smoothly and without hindrance.

3.05 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

END OF SECTION

SECTION 12 32 00

MANUFACTURED WOOD CASEWORK

## PART 1 - GENERAL

1.01 SUMMARY

A. Provide modular casework, of types and sizes shown on the Drawings and in Schedules, complete in place, as specified herein, and as needed for a complete and proper installation.

1.02 RELATED REQUIREMENTS

A. Division 22 - PLUMBING: All plumbing work related to items in this Section

B. Division 26 - ELECTRICAL: All electrical work related to items in this Section

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
2. Materials schedule: A complete schedule of casework components, coordinated with the Contract Drawings.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
4. Selection samples:
   a. Sample card indicating Manufacturer's full range of colors of laminate, edging or other surfacing material, available for selection by Architect.
   b. Provide additional samples as requested by Architect for initial selection of colors and finishes.
5. Verification samples: All hardware items (hardware samples will be returned to the Contractor after review.

1.04 QUALITY ASSURANCE

A. Workmen: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics authorized by manufacturer.

1.05 PRODUCT HANDLING

A. Delivery and Storage: Casework shall be protected in transit. Deliver materials under protective cover and store within dry enclosed space. Do not expose to extreme temperature and humidity changes.

1. Do not store or install casework in building until concrete, masonry, and plaster work is dry.
2. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no change in Contract Sum.

1.06 COORDINATION AND SCHEDULING

A. Coordinate work of this Section with related work of other Sections as necessary to obtain proper installation of all items.

B. Verify site dimensions of cabinet locations in building prior to fabrication.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

A. Manufacture: To establish a standard of quality, design and function desired, Drawings and specifications have been based on KraftMaid Cabinetry, Inc. Similar products manufactured by others, may be considered as an equal by the Architect.

B. Cabinet Door/Drawer Style: Full Overlay, KraftMaid Cabinetry "Sonora" Style.
1. Wood Species: White Maple, in stained finish selected by the Architect from manufacturers' standard finishes.

2.02 CABINET MATERIALS

A. Exposed Materials: Comply with the following:
1. Exposed Wood Species: Maple
a. Unless otherwise indicated, do not use two adjacent exposed faces shall be similar that are noticeably dissimilar in color, grain, figure, and or natural character markings.
2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, kiln dried to 7 percent moisture content.
3. Plywood: Hardwood plywood complying with HPVA HP – 1 face veneer of species indicated, selected for compatible color and grain with Grade A faces and Grade C backs of same species as faces.
a. Edge band exposed edges with minimum 1/8 inch (3 mm) thick, solid-wood edging of same species as face veneer.

4. Vinyl-Faced Fiberboard: Medium-density fiberboard complying with ANSI A208.2, milled to required shapes, with a thermoformed vinyl overlay applied in a vacuum or membrane press.
5. Thermoset Decorative Overlay: Medium-density particleboard complying with ANSI A208-1, Grade M-2; with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
    a. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed surfaces.

B. Semi-exposed Materials: Unless otherwise noted, provide the following:
1. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces and backs stained to be compatible with exposed surfaces.
2. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces stained to be compatible with exposed surfaces and Grade 3 backs of Birch species, with clear finish.
3. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C fac
4. stained to be compatible with exposed surfaces and an embossed, natural birch vinyl film adhesively bonded to the plywood.
5. Vinyl-Faced Particleboard: Medium density particleboard complying with ANSI A208.1, Grade M-2 with an embossed, wood grain-patterned vinyl film adhesively bonded to particleboard.
    a. Provide vinyl film on both sides of shelves, dividers, and other components with two semi-exposed surfaces and semi-exposed edges.

C. Concealed Materials: Comply with the following:
1. Plywood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Particleboard: ANSI A208.1, Grade M-2

D. Solid Wood Edges and Trim: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, kiln dried to 7 percent moisture content.
1. Wood Species: Maple.

## 2.03 CASEWORK HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, type, material, size, and finish as selected from manufacturer's standard choices.

B. Hinges: Concealed European-style, 6-way adjustable hinges.

C. Drawer Guides: Undermount, self-closing drawer guides, designed to prevent rebound when drawers are closed; with nylon-tired, ball bearing rollers; and complying with BHMA A156.9, type B05091.

1. Full-extension buffered runners with easy-release mechanism.

D. Locks where indicated: to be disc tumbler lock keyed alike and master keyed. Dull chrome finish.

2.04 CABINET CONSTRUCTION

A. Face Style: Reveal overlay: door and drawer faces partially cover body or face frame.

B. Face Frames: 3/4-by-1 1/2-inch (19-by-38-mm) solid wood.

C. Door and Drawer Fronts: Solid wood stiles and rails, 3/4-inch (19mm), with 1/4-inch (6.4mm) thick, veneer-faced plywood center panels.

D. Exposed Cabinet Ends: 3/4-inch (19mm) thick, veneer-faced plywood with natural birch veneer interior.

E. Cabinet Tops and Bottoms: 1/2-inch (12.7mm) thick, vinyl-faced particleboard or 1/2- inch (12.7mm) thick natural birch veneer-faced plywood, supported by and secured in rabbits in end panels and front face frame.

F. Base Unit Top Rails: 3/4 by 2 3/4-inch solid wood, interlocking with end panels, and secured under pressure with glue and with mechanical fasteners.

G. Wall-Hung Unit Top and Bottom Rails: 1/2 by 2 1/2-inch solid wood, interlocking with end panels, and secured with glue and mechanical fasteners.

H. Base Unit Back Panels: 3/8-inch vinyl-faced or veneer particleboard fastened to rear edge of end panels and to top rail.

I. Wall-Hung Unit Backs: 3/16-inch thick plywood or 1/8-inch hardboard, captured on the end panels and fastened to the top and bottom rails.

J. Front Face Frame Drawer Rails: 3/4-by-1 1/2-inch solid wood fastened into face frame.

K. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. 1. Join subfronts, backs, and sides with glued dovetail joints.
2. 2. Subfronts, backs, and sides: 3/4-inch (19mm)-thick solid wood.

L. Shelves: 3/4-inch (19mm)-thick particleboard or 5/8-inch-(16mm)-thick plywood.

M. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops bottoms, and backs into end panels.

N. Factory Finishing: To the greatest extent possible, finish casework at the factory. Defer only final touch up until after installation.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Erect casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, etc.

B. Install all items complete and adjust all moving parts to operate properly.

C. Leave surface clean and free from defects at time of final acceptance.

3.02 CLEANING

A. Clean Up: Remove all cartons, debris, sawdust, scraps, etc., and leave spaces clean and all casework ready for Owner's use.

END OF SECTION

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SECTION 12 36 61.16

SOLID SURFACING COUNTERTOPS

## 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. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

B. Related Requirements:

1. DIVISION 22 “PLUMBING” sinks and plumbing fittings.

### 1.03 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. Wood trim, 8 inches long.
3. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

### 1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.08 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.01 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

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. DuPont; DuPont de Nemours, Inc.
b. Formica Corporation.
c. LG Hausys, Ltd.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

## 2.02 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium

B. Configuration:

1. Front: Radius edge with apron, 2 inches high with 3/8-inch radius
2. Backsplash: Straight, slightly eased at corner
3. End Splash: Matching backsplash

C. Countertops: 3/4-inch-thick, solid surface material front edge built up with same material

D. Backsplashes: 3/4-inch-thick, solid surface material.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops without joints.

G. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.

H. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
   b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
   c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

## 2.03 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION

SECTION 12 40 00

EQUIPMENT, FURNISHINGS AND ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This Section covers all miscellaneous equipment, furnishings, and tools as indicated herein or on the Drawings.

B. The Contractor shall provide all equipment, materials, tools and labor to furnish, assemble and install the furnishings and accessories.

C. See Contract Drawings for equipment/furnishing/tool quantities.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. The Contractor shall submit to the Engineer for review six sets of shop drawings, test reports, and certifications, as indicated herein.

1.03 DESIGN CRITERIA

A. All equipment supplied shall be the manufacturer's latest and proven design and shall meet all specifications as stated on the models specified. These specifications call attention to certain features but do not purport to cover all details entering into the design of the equipment. Final approval on all equipment shall be given by the Engineer.

B. Contractor shall be responsible for notification to, and coordination with, other trades. If the equipment provided differed from that specified herein. Contractor shall provide all relevant data and requirements (e.g., power, structural) required by other trades for installation and operation of the equipment. Contractor shall coordinate utility requirements for approved equipment with subcontractors to ensure proper services and utilities are provided for approved equipment. Contractor is responsible for providing alternate services for approved equipment at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 WORK BENCHES (ADD ALT 7)

A. STEEL WORKBENCH (10,000 lbs. CAPACITY) (D-1) (ADD ALT 7)

1. Contractor to provide the quantity of workbenches with a steel top as indicated on the Equipment Drawings. Workbenches shall meet the following requirements:

a. Steel top dimensions – 72-inches x 36inches
b. Welded leg assembly fixed at 34 inch height
c. Extra strong 7 gauge reinforced steel top supporting up to 10,000 lbs
d. Heavy 2”x2” angle legs ¼” thick with welded 7 ga. Gussets
e. 3”x3” footpads with anchor holes
f. Powder coated finish
g. Bench shall be Little Giant Product No. HWW-3672, or approved equal by Cisco-Eagle, Gilmore Kramer, Grainger or other approved equal.

B. STEEL WORK BENCH WITH CASTERS (10,000 LBS CAPACITY) - (D-2) (ADD ALT 7)

1. Contractor to provide the quantity of workbenches with a steel top as indicated on the Equipment Drawings. Workbenches shall meet the following requirements:

a. Steel top dimensions – 72-inches x 36inches
b. Welded leg assembly fixed at 34 inch height
c. Extra strong 7 gauge reinforced steel top supporting up to 5,000 lbs
d. Heavy 2”x2” angle legs ¼” thick with welded 7 ga. Gussets
e. 8” phenolic casters – 2 rigid, 2 swivel with floor lock
f. Powder coated finish
g. Bench shall be Little Giant Product No. HWW-3672-8PHFL, or approved equal by Cisco-Eagle, Gilmore Kramer, Grainger or other approved equal.

C. ELECTRIC CHARGING STATION WORKBENCH - (D-3) (ADD ALT 7)

1. Contractor to provide electric charging workbenches with a steel top as indicated on the Drawings. Workbenches shall meet the following requirements:

a. Steel top dimensions – 72-inches x 30 inches
b. Channel-shaped stringer that ties legs rigidly together
c. High pressure plastic laminate top
d. Front panel with flour duplex outlets. Electronics riser with four more duplex outlets
e. Benches shall be provided with two wiring kits. Each wiring kit comes with 4 duplex receptacles, on/off switch with pilot light, 8’ grounded cord and plug, 15 amp, 115 volt service and circuit breaker
f. Bench shall be Tennsco Model No. EB-2-3072S, or approved equal by Grainger, Cisco-Eagle, Gilmore Kramer, or other approved equal.
g. Bench wiring kit shall be Tennsco Model No. WK-1, or approved equal by Grainger, Cisco-Eagle, Gilmore Kramer, or other approved equal.

## 2.02 HYDRAULIC HOSE EQUIPMENT

### A. PORTABLE HYDRAULIC HOSE CRIMPING MACHINE (E-1)

1. Contractor shall provide and install a hose crimp machine as indicated on the Equipment Drawings. The hose crimp machine shall conform to the following requirements:

    a. Unit shall be Gates Mobilecrimp 4-20 Crimper or approved equal.
    b. Unit shall be able to crimp up to 1-1/4" four spiral-wire hose.
    c. Unit shall be supplied with die sets for the following hose sizes: ¼-inch, 3/8-inch, ½-inch, 5/8-inch, ¾-inch, 1-inch and 1-1/4-inch

### B. HYDRAULIC HOSE CUBBY STORAGE (E-2)

1. Contractor to provide and install the quantity of bin storage units as indicated on the Equipment drawings. Bin units shall conform to the following:

    a. Unit shall be Quantum WR9-202 Chrome Wire Shelving Plastic Shelf Bins Item #: WG268945BL or approved equal.
    b. Unit shall include (40) 6"H blue plastic shelf bins.
    c. Dimensions shall be 36" W x 12" D x 74" H with 9 shelves.

### C. HOSE REEL RACK (E-3)

1. Contractor to provide and install one (1) hose reel rack as indicated on the Equipment Drawings. Unit shall conform to the following:

    a. Unit shall store 3 hydraulic hoses.
    b. Overall dimensions 28-inches wide X 30-inches deep X 72-inches high.
    c. Unit shall be Gates No. 78186 or approved equal.
    d. Unit shall have a black finish.

### D. HYDRAULIC HOSE SAW (E-4)

1. Contractor to provide and install one (1) hydraulic hose saw as indicated on the Equipment Drawings. Unit shall conform to the following:

    a. Unit shall be Clean-Cuts Hydraulic Hose Saw Model No. HYDM100-220V or approved equal.
    b. Motor shall be 5 HP, 220 VAC, 1 Phase, 60 Cycle, 3,490 RPM
    c. Blade shall be one 10" OD x .125 THK X 40 mm arbor
    d. Unit shall have a cutting capacity of 2" ID x 6 Wire Hydraulic Hose

## 2.03 WELDING EQUIPMENT

### A. MIG WELDER (F-1)

1. Contractor to provide a MIG welder as indicated on the Drawings. MIG welder shall conform to the following:

    a. Unit shall be Miller Electric Millermatic 252 model or approved equal.
    b. Electrical requirements shall be as followed: 208V/1ph/48A.
    c. Wire feed speed shall be 50-700 ipm.
    d. Maximum spool size shall be 12 in.
    e. Maximum open-circuit voltage shall be 38V.
    f. Dimensions shall be 30 in. H x 19 in. W x 40 in. D.

### B. TORCH CART (F-2)

1. Contractor shall provide one (1) portable oxygen/acetylene torch set with a cart as indicated on the drawings. The torch set shall include to the following:

    a. High CA 2460 Cutting Attachment
    b. ESS4 Edge Series Regulators - ESS4-125-540 & ESS4-15-300
    c. Size 1 Welding nozzle - welds up to 3/32" (2.4mm)
    d. Size 3 Welding nozzle - welds up to 3/16" (4.8mm)
    e. Size 5 Welding nozzle - welds up to 1/2" (12.7mm)
    f. MFA Heating Nozzle, Size 8
    g. 1-1-101 Cutting Tip - Cuts up to 3/4" (19mm)
    h. T-Grade Hose 20' x 1/4"
    i. Striker and tip cleaner
    j. Soft sided goggles
    k. Cart shall have foam fill wheels
    l. Cart shall hold oxygen cylinders with 9-1/4” diameter and acetylene cylinders with 13-1/2” diameters
    m. Cart shall have a weight capacity of 500LBS
    n. Cart shall be a 2-cylinder cart with a lifting eye
    o. The cart shall be as manufactured by Global Industrial Item # T9F985439, or approved equal.
    p. Torch set shall be made by Welder Supply Company Model “Victor Heavy Duty Journeyman Professional Outfit #0384-2100” or approved equal.

C. WELDING SCREEN (F-3)

1. Contractor shall provide and install the quantity of welding screens as indicated on the Equipment Drawings. Welding screens shall conform to the following requirements:

    a. Units shall be Steiner Protect-O-Screen Classic Welding Screen – Orange Transparent Vinyl Model# 53886, Item# 170377 or approved equal.
    b. Size shall be 72" L x 96" W.
    c. Screen material shall be vinyl.
    d. Frame material shall be 18-gauge steel.
    e. Units shall be Steiner Protect-O-Screen Classic Welding Screen – Orange

D. OXYGEN/ACETYLENE STORAGE CAGE (F-5)

1. Contractor shall provide and install the quantity of oxygen/acetylene storage cages as indicated on the Equipment Drawings. Storage cages shall conform to the following requirements:

    a. Dimensions shall be 30" L x 31" W x 65" H
    b. Capacity to hold 9 cylinders (20 or 33 lb.)
    c. Constructed of 14 gauge steel
    d. 1/8" x 1-3/16" expanded metal doors
    e. Include sign reading "DANGER FLAMMABLE MATERIALS"
    f. Unit shall be Global Industrial Cylinder Storage Cabinet Item #: T9F270256 or approved equal.

E. PORTABLE WELD FUME EXTRACTOR (F-6)

1. Contractor shall provide and install the weld fume extractor as indicated on the Equipment Drawings. Unit shall conform to the following requirements:

    a. Dimensions shall be 48" L x 31.75" W x 34.75" H
    b. Filter Media: 490 $ft.^2$
    c. Airflow: 875 CFM
    d. Motor: 1 HP, 3450 RPM
    e. Input Power: 115V/1ph/60HZ/11.9A
    f. Extraction Arm: 8-in diam., 7-ft long
    g. Unit shall be Miller Filtair MWX-D Fume Extractor w/ 7-ft Extraction Arm (951507) or approved equal.

## 2.04 TIRE MAINTENANCE EQUIPMENT

### A. TIRE CHANGER (G-1)

1. Contractor shall provide and install a table-top tire changer as indicated on the Equipment Drawings. The tire changer shall conform to the following requirements:

   a. Unit shall be Hunter TCX57W or approved equal.
   b. Unit shall have a 220V 1 phase motor
   c. Unit shall have a 4 clamp wheel clamping method and be air cylinder operated.
   d. Dimensions shall be 60 in. W x 48 in. D x 82 in. H.
   e. Unit shall have a 6 in. to 30 in. external rim diameter, 14.5 in. rim width, and 43 in. wheel diameter.
   f. Unit shall have wheel lift included

### B. WHEEL BALANCER (G-2)

1. Contractor shall provide and install a wheel balancer as indicated on the Equipment Drawings. The wheel balancer shall conform to the following requirements:

   a. Unit shall be Hunter SWT-12 SmartWeight Touch Balancer or approved equal.
   b. Max. Tire diameter shall be 44 in
   c. Max tire width shall be 20 in.
   d. Max tire weight shall be 175 lbs
   e. Unit shall come with 20-2765-1 BullsEye collet & storage kit
   f. Unit shall come with 20-1839-1 Adjustable flange plate & stud kit
   g. Unit shall come with 20-3116-1 Medium-duty centering kit

### C. SMALL TIRE STORAGE RACK (G-3)

1. Contractor to provide and install the quantity of heavy duty tire storage racks as indicated on the Equipment Drawings. Tire storage racks shall conform to the following:

   a. Double riveted tire support beams for high capacity.
   b. Storage width of 60-inches.
   c. Adjustable tire storage levels, adjust levels as requested by Owner to fit tire sizes.
   d. Minimum capacity 21 tires, 2,000 lbs. per shelf.
   e. Rack base model shall be TENNSCO ZST-6060S. Provide number and sizes of units as appropriate to provide the total linear footage of shelving indicated on the Drawings.
   f. Manufacturer shall provide rack support system which meets seismic requirements of the New York State Building Code and ASCE Seismic Design Requirements for Non-Building Structures. Manufacturer shall submit appropriate documentation to demonstrate that these requirements have been met.

g. The tire storage rack shall be bolted to the floor or wall in accordance with manufacturer requirements.
h. See Drawings for total length of tire storage racks to provide.

## 2.05 STORAGE EQUIPMENT (ADD ALT 7)

### A. PALLET RACK (H-1) (ADD ALT 7)

1. Contractor to provide and install the quantity of heavy pallet racks and wire mesh decking as indicated on the Equipment drawings. Provide the total linear footage as indicated on the Drawings. Pallet racks shall conform to the following:

   a. Dimensions: 48” W x 42” D x 144” H (starter) 46” W x 42” D (decking)
   b. Capacity: 38,400 lbs. (Pallet Rack) 6,950 lbs. (shelf) 2,700 lbs. (decking)
   c. 13-gauge steel uprights with 2” increment height adjustments
   d. 15-gauge steel beams with 1-5/8” step beams
   e. 3”x3” columns
   f. Units shall be Tear Drop Pallet Rack Starter Item #: WBB2282537 and Wire Decking Item #: WG798564 as manufactured by Global Industrial or approved equal.

### B. STORAGE CABINET (H-2) (ADD ALT 7)

1. Contractor to provide and install the quantity of storage cabinets as indicated on the Equipment drawings. Storage cabinets shall conform to the following:

   a. Unit shall be Global Industrial Storage Cabinets Item #: T9F603357BK or approved equal.
   b. Dimensions shall be 78” H x 48” W x 24” D.
   c. Shelf capacity shall be 300 lbs.
   d. 4 Shelves
   e. Storage cabinets shall lock at 3 points using a keyed mechanism.

### C. BIN STORAGE (H-3) (ADD ALT 7)

1. Contractor to provide and install the quantity of bin storage units as indicated on the Equipment drawings. Bin units shall conform to the following:

   a. Unit shall be Quantum Steel Wire Bin Shelving Item #: 1UVT5 or approved equal.
   b. 6 shelves
   c. Unit shall include 13 blue plastic shelf bins:
   d. (9) 29-7/8” L x 11” W x 10” H
   e. (4) 29-7/8” L x 16-1/2” W x 11” H
   f. Dimensions shall be 36” W x 30” D x 74” H with 13 shelves.
   g. Load Capacity: 5,000 lbs.

D. FLAMMABLE CABINETS (H-4) (ADD ALT 7)

1. Contractor to provide and install the quantity of flammable cabinets as indicated on the Equipment drawings. Flammable cabinets shall conform to the following:

   a. Units shall be Justrite Flammable Cabinet with Manual Close Double Door 45 Gallon Item #: T9F942746 or approved equal.
   b. Overall dimensions shall be 43" wide x 18" deep x 65" high
   c. Unit shall have 2 adjustable shelves.
   d. Unit shall have 3 openings.
   e. Shelf capacity shall be 350 lbs.

E. SMALL PARTS DRAWER STORAGE (H-5) (ADD ALT 7)

1. Contractor to provide and install the quantity of bin storage units as indicated on the Equipment drawings. Bin units shall conform to the following:

   a. Unit shall be Durham Slide Rack 308-95 Item #: WCB485450 or approved equal.
   b. Unit shall fit six boxes.
   c. Dimensions shall be 15-1/4" L x 11-3/4" W x 16-3/8" H.

F. PARTS SHELVING (6'x2') (H-6) (ADD ALT 7)

1. Contractor to provide and install the quantity of duty steel storage shelves as indicated on Equipment Drawings. Provide a total linear footage of shelving as indicated on the Drawings. Shelves shall conform to the following:

   a. 14-gauge steel, nut and bolt assembly.
   b. Minimum shelf dimensions shall be 24-inches deep x 72-inches long x 84-inches high with 4 shelves (one at floor level).
   c. Minimum shelf capacity shall be 3,000 lbs. per shelf. All shelving shall be Grainger Model No. 7E514 or approved equal by Gilmore Kramer, Cisco Eagle, or other approved equal.
   d. Provide supports as recommended by the manufacturer to support specified shelf capacity.
   e. Manufacturer shall provide shelving support system which meets seismic requirements of the Massachusetts State Building Code and ASCE Seismic Design Requirements for Non-Building Structures. Manufacturer shall submit appropriate documentation to demonstrate that these requirements have been met.

G. CANTILEVER RACK (H-7) (ADD ALT 7)

1. Contractor to provide and install the quantity of level arm cantilever racks as indicated on the Equipment Drawings. Cantilever racks shall conform to the following:

a. Unit shall be Jarke Straight Cantilever Rack Item #: 3W588 or approved equal.
b. Unit shall have 1 side with 8 arms.
c. Each arm shall have a capacity of 2000 lbs. for a total capacity of 12,530 lbs.
d. Unit shall be 8 ft. in height.
e. Arms shall be 24" long.
f. Center brace length shall be 72".
g. Arms shall be straight.
h. Arms and columns shall be 11-gauge steel.
i. Rack size width shall be 37".

H. CUBBY STORAGE (H-8) (ADD ALT 7)

1. Contractor to provide and install the quantity of cubby storages as indicated on the Equipment Drawings. Cubby storage shall conform to the following:

a. Unit shall be Durham 104 Bin, Small Parts Storage Bin #740-95 or approved equal.
b. Unit shall be all welded, prime cold rolled steel
c. Unit shall have fully hemmed 1-1/8" bin fronts
d. Unit shall have a gray powder coat finish
e. Unit shall be 33-3/4"Wx12"Dx64-1/2"H
f. Bin Dimensions shall be 3-13/16"W x 11-7/8"D x 3-3/8"H

2.06 MISCELLANEOUS EQUIPMENT

A. 10-TON ANCHOR POTS WITH PULLING POSTS (M-1)

1. Contractor to provide and install 10-ton anchor pot floor system as indicated on the Drawings. Contractor shall coordinate construction sequencing to include the anchor pot installation prior to pouring the floor slab. Anchor pot floor system shall be Champ Olympian 10 ton pulling post starter kit SKU No. 4021 as provided by Auto Body Tool Mart, or other approved equal. Additional anchor pots needed to configure the floor system shall be Champ 1600 SKU No. 1600 as provided by Auto Body Tool Mart, or other approved equal. Contractor shall follow manufacturer recommendations for anchor pot installation and shall place the anchor pots in the configuration shown on the Drawings. Anchor pots and appurtenances shall include the following:

a. one - 4007 Champ Power Pull Post
b. two - 1005 5 foot chain with claw hook
c. two - 1008 8 foot chain with claw hook
d. one - 7290 Chain lock with wire ring
e. one - 5050 Hi-Flow hose half coupler
f. one - 5751 10 ton 10-inches choke ram
g. one - 5700 hydraulic air pump
h. one - 2431 side pull clamp
i. two - 7005 chain shortener
j. one - 5030 6 foot hydraulic hose

k. one - 2430 3 way angle pull clamp
l. one - 2516 Model JR self-tightening clamp
m. Twenty - 1600 floor anchor pots having a full 10 ton capacity.
n. Anchor pots shall have shall have a removable chain to eliminate the need to replace the pot if the chain breaks.
o. Anchor pot shall be 3.5-inches in diameter and shall use 3/8-inches chain.
p. Anchor pots shall be able to be removed and reinstalled.
q. Anchor pot shall consist of an anchor lid, anchor chain, anchor sleeve, chain retaining wedge, and anchor expander.
r. Chain shall have an ultimate strength of 26,400 lbs.

B. DRILL PRESS (M-2)

1. Contractor shall provide and install a drill press as indicated on the Equipment Drawings. The drill press shall conform to the following requirements:

a. Unit shall be Jet 354170 JDP-20MF Floor Drill Press or approved equal.
b. Electrical requirements shall be as followed: 1-1/2 HP, 115V/230V, single-phase.
c. Unit shall have a 20” swing.
d. Drill chuck shall be 3/4”.
e. Drilling capacity shall be 3/4” steel.
f. Spindle travel shall be 4-5/8”.

C. HEAVY DUTY ANVIL BENCH VICE (M-3)

1. Contractor shall provide and install a bench vice as indicated on the Equipment Drawings. The bench vice shall conform to the following requirements:

a. Unit shall be Wilton 8” Ductile Alloy Tradesman’s Vise, 4-3/4” Throat Depth Item #4LT65, Mfr. Model #1780A or approved equal.
b. Jaw width shall be 8”.
c. Max. opening shall be 7”.
d. Throat depth shall be 4-3/4”.
e. Pipe capacity shall be 1/8 to 3-1/2”.
f. Unit shall include swivel base.
g. Unit shall have 60,000 psi body casting.

D. PARTS WASHER (M-4)

1. Contractor shall provide and install a parts washer as indicated on the Equipment Drawings. The parts washer shall conform to the following requirements:

a. Unit shall be Homak 40 Gallon Parts Washer Model No. RD00840450 or approved equal
b. Unit shall have a large one piece tank for cleaning big part
c. Unit shall have a 5.6 GPM Max Flow Rate
d. Unit shall be 36-3/4”H x 46-7/8”W x 22-7/8” D.

e. Unit shall have a capacity of 40 gallons
f. Unit shall have a red finish

E. 8” BENCH GRINDER (M-5)

1. Contractor shall provide and install a bench grinder as indicated on the Equipment Drawings. The bench grinder shall conform to the following requirements:

a. Unit shall be Jet 8” Bench Grinder Model No. IBG-8VS or approved equal
b. Unit shall be 115 V, 1 Hp, 3600 Max RPM, 6/8” Arbor, 11/5.5 Amps
c. Unit shall have attached light
d. Unit shall be 23-27/64”L x 9-29/64”H
e. Unit shall have a 2” exhaust port

F. BATTERY CHARGER (M-6)

1. Contractor shall provide and install a battery charger as indicated on the Equipment Drawings. The battery charger shall conform to the following requirements:

a. Unit shall be Associated Model US20 or approved equal
b. Unit shall have 40A/10A @ 12V, 40A @ 6V Charging amps @ voltage
c. Unit shall include clamp bar
d. Unit shall be 12”W x 14-1/2”D x 24”H

G. BRAKE FLUID EXCHANGER (M-7)

1. Contractor shall provide and install a brake fluid exchanger as indicated on the Equipment Drawings. The brake fluid exchanger shall conform to the following requirements:

a. Unit shall be Motorvac Brakevac II Brake Fluid Flush System Part No. 500-8105 or approved equal
b. Unit shall have a 1 gallon fluid tank & removable waste tank
c. Unit shall have a 10 foot pressure hose with quick disconnect
d. Unit shall have an adjustable pressure regulator that controls operation pressure

H. 3-TON FLOOR JACK (M-9)

1. Contractor shall provide and install a 3-Ton floor jack as indicated on the Equipment Drawings. The 3-Ton floor Jack shall conform to the following requirements:

a. Unit shall be Strongway 3-Ton Hydraulic Quick Lift Low-Profile Floor Jack Item #46226 or approved equal
b. Unit shall have a maximum working load of 6,000 lbs.
c. Unit shall have a dimensions of 26.93”L x 13.35”W x 6.3”H
d. Unit shall have a minimum lift height of 4”

e. Unit shall have a maximum lift height of 18.31”

I. 5-TON FLOOR JACK (M-10)

1. Contractor shall provide and install a 5-Ton floor jack as indicated on the Equipment Drawings. The 5-Ton floor Jack shall conform to the following requirements:

a. Unit shall be Strongway 5-Ton Hydraulic Long-Frame Floor Jack Item #46211 or approved equal
b. Unit shall have a maximum working load of 10,000 lbs.
c. Unit shall have a dimensions of 59.45”L x 14.96”W x 8.27”H
d. Unit shall have a minimum lift height of 5.94”
e. Unit shall have a maximum lift height of 22”

J. AC RECOVERY AND RECHARGE SYSTEM (M-11)

1. Contractor shall provide and install an AC Recovery and Recharge System as indicated on the Equipment Drawings. The AC Recovery and Recharge System shall conform to the following requirements:

a. Unit shall be Tektino Fully Automatic Recovery, Recycle & Recharge Machine or approved equal
b. Unit shall have both R134a & R1234yf
c. Unit shall have a recovery speed of 0.25kg/min
d. Unit shall have a vacuum pump capacity of 60L/min
e. Unit shall have a capacity of 10KG of each R-134a and HFO-1234yf

K. DRUM DOLLEY (M-23)

1. Contractor shall provide and install drum dollies as indicated on the Equipment Drawings. The drum dollies shall conform to the following requirements:

a. Unit shall be Global Industrial 55-Gallon Drum Truck Item #T9F233882 or approved equal
b. Unit shall be 24” diam.
c. Unit shall have a capacity of 600 lbs.
d. Unit shall be constructed of steel
e. Unit shall have (4) 3” diam. rubber wheels

L. MOBILE PLATFORM (M-24)

1. Contractor shall provide and install a mobile platform as indicated on the Equipment Drawings. The mobile platform shall conform to the following requirements:

a. Unit shall Cotterman Series A Mobile Platform Model No. A8R2630 or approved equal

b. Unit shall have 8 steps with handrails
c. Unit shall have 24” tread width
d. Unit shall have base dimensions of 30”W x 63”L
e. Unit shall have a load rating of 350 lbs.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall install equipment in accordance with manufacturer's requirements.

B. Contractor to furnish and install supports as required by the equipment manufacturer and building codes to ensure the systems are seismically rated as described above, and shall bolt the equipment to floor and provide other supports as needed.

C. Contractor shall confirm utility needs prior to installing the equipment and coordinate with all trades as needed.

D. The General Contractor shall perform all other work necessary to provide a complete and operable system, in accordance with the manufacturer requirements, and shall provide the linear footage of items as indicated on the Drawings.

END OF SECTION

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SECTION 12 48 13

ENTRANCE FLOOR GRILLES

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Recessed aluminum foot grilles.
2. Entrance matting systems, recessed aluminum foot grilles.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

B. Section 06 20 00 - FINISH CARPENTRY: Installing metal thresholds.

C. Section 08 71 00 - DOOR HARDWARE: Furnishing metal thresholds.

D. Section 09 30 13 – CERAMIC TILE.

E. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Straight resilient base, where indicated in conjunction with floor grilles.

F. Section 09 68 13 – TILE CARPETING.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. ASTM C1028 Static Coefficient of Friction
2. ASTM B117 Product Corrosion to Salt

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work

B. Sequencing:

1. Field Measurements
   a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.05 SYSTEM DESCRIPTION

A. Performance Requirements: Provide recessed aluminum entrance floor mat system, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.06 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including grilles, accessories and leveling materials. Include manufacturer's application methods or installation instructions for each item furnished hereunder.
2. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.
3. Certificates: Provide certificate stating that the floor mat, and other related materials to be supplied hereunder meet all requirements specified herein.
4. Samples: Submit samples for each type and color of exposed entrance mat, frames and accessories required. Provide samples of mat materials.

1.07 QUALITY ASSURANCE

A. Installer: Installer should be highly experienced in performing work of this section, having previously done work similar to that required for this project.

1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of

damage, unless Engineer specifically authorizes correction thereof and usage on project.

## PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Mats Inc., Stoughton MA., Product: "Grate Grid".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Aluminum Entrance Grilles:
   a. Mats Inc., Stoughton MA.
   b. Nystrom, Inc., Minneapolis, MN.
   c. Balco Inc., Wichita KS.
   d. Construction Specialties, Inc., Muncy, PA.

2.02 PERFORMANCE REQUIREMENTS:

A. ASTM C1028 Static Coefficient of Friction: 0.65 Wet

B. ASTM B117 Product Corrosion to Salt: Product withstands 1000 hours of salt fog without any noticeable changes.

2.03 MATERIALS

A. Foot grille:

1. Corrosion resistant 6063-T52 aluminum with durable "I"-beam construction secured with keylock bars. Tread rails shall be manufactured from aluminum, complete with co-extruded soft-durometer cushions, supplied in mill finish.
2. Carpet shall meet the Carpet and Rug Institute's standard for indoor air quality. Fibers shall include a minimum of 100, 12 mil monofilament fibers per square inch and colorfast, solution dyed nylon. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Carpet weight shall be 33 oz./square yard in color selected by the Engineer from the manufacturer's full range of available colors.
3. Polybrush shall be solution dyed polypropylene fibers with 4,500 total denier, colors as selected by the Engineer from the manufacturer's full range of available colors. Textured fibers have ultraviolet blockers and color as an integral part of the filament. Each carpet fiber and monofilament shall be fusion- bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Carpet

weight shall be 27 oz./square yard.

4. Vinyl shall include a flexible dual durometer vinyl insert in color selected by the Engineer from the manufacturer's full range of available colors.

B. Framing for Aluminum Foot Grille:

1. Aluminum frame shall be a 2 inch deep recessed frame in 6063-T5 aluminum alloy with 3/16 inch wide exposed surface. Frame color shall be mill finish. Frames in contact with concrete to be primer coated.

C. Accessories:

1. Recessed pan: 20 gauge aluminum.
2. Accessories: Stainless steel hinges. Galvanized Steel keyless-lock downs attached to each grid section.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.02 PREPARATION

A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all in situ surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

### 3.03 INSTALLATION

A. Sizes: Shop-fabricate units of floor mat to greatest extent possible in sizes as indicated. Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints. Where possible, verify sizes by field measurement before shop fabrication.

B. Accessories: Where indicated for recessed or wall-to-wall applications, provide aluminum framework as recommended by manufacturer.

C. General: Strictly comply with manufacturer's installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and to prevent tripping hazards.

3.04 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

B. Clean work under provisions of Section 01 74 13 – CLEANING UP.

END OF SECTION

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SECTION 12 48 43

FLOOR MATS

## PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install the following:

1. Rolled entrance matting where indicated on the Drawings, including all accessories necessary to complete the work.
   a. Provide two (2) 5 foot by 7 foot and two (2) 8 foot by 10 foot mats, one set for each building.
2. Sub-floor filler, as required to ensure the specified tolerance level for finish surface of matting.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate.

B. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS: Thresholds at intersection of floor mats.

C. Section 09 65 23 - RUBBER FLOORING.

1.03 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM E 648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including floor mat, accessories, adhesives, and leveling materials. Include manufacturer's application methods or installation instructions for each item furnished hereunder.
2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation.
3. Manufacturer's certificate: Provide certificate stating that the floor mat, and other related materials to be supplied hereunder meet all requirements specified herein.

4. Selection samples: Sample swatches containing manufacturer's full color, blend range and size.
5. Verification samples: (submit [two] each): After initial selection of floor mat and color blends has been made by the Engineer: 18-inch by 36-inch sample of selected floor mat for final approval of the Engineer. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Maintain a temperature of at least 60 degrees Fahrenheit, with a relative humidity of between 15 and 60 percent, for a period of 48 hours before, during, and after installation.

B. Store all mat materials under cover in dry, well-ventilated spaces as soon as delivered. Protect floor mating from damage, dirt, stain, moisture, and mildew.

1.06 ENVIRONMENTAL CONDITIONS

A. Store materials for 3 days prior to installation in area of installation to achieve temperature and humidity stability.

B. Maintain minimum 70 degrees Fahrenheit ambient temperature 3 days prior to, during, and 24 hours after installation of materials.

1.07 SEQUENCING AND SCHEDULING

A. Sequence work to ensure floor mat is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and work overhead is completed.

B. Install floor mat after interior wet work is complete and fully cured.

1.08 WARRANTY

A. Provide 3 year warranty under provisions of Section 01 78 00 – PROJECT CLOSEOUT. Warranty shall include texture retention, wear, and static protection and edge ravel resistance and run resistance strength for the life of the matting. Commencing on the date of substantial completion.

B. Mat installer's written guarantee covering prompt and proper replacement of any and all floor mating which indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Engineer, said corrective work being performed by the mat installer at no cost to the Owner.

1.09 EXTRA MATERIALS

A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, provide 4 mats matching those installed.

B. Clearly label and package extra materials securely to prevent damage.

## PART 2 - PRODUCTS

### 2.01 WALK-OFF FLOOR MATS

A. Manufacturers: Subject to compliance with all of the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:

1. Mats Inc., Stoughton, MA.
2. Pawling Corporation, Wassaic, NY.
3. Tek Stil Concepts Inc., Haddonfield, NJ.

B. Floor matting, (Loose laid): To establish a standard of quality, design and performance desired, specifications have been based on a Mats Inc., Stoughton, MA., product "Super Nop 52", conforming to the following:

1. Criteria:

| | |
|---|---|
| Construction: | 100 percent solution-dyed UV stabilized polypropylene fibers with 20 percent post-consumer recycled content. |
| Pile (face) Weight: | 52 ounces/square yard. |
| Backing: | High Density Rubber. |
| Length: | Approximately 101'-8". |
| Roll Widths: | 6' -7" by 101' -8" and 13'- 2" by 101'-8". |
| Thickness: | ½ inch. |
| Color: | As selected by Engineer from manufacturer's full available range. |

### 2.02 ACCESSORIES

A. Subfloor filler: Premix latex-type as recommended by the floor mat manufacturer.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected. Beginning of installation means acceptance of existing substrate and site conditions.

## 3.02 PREPARATION

A. Remove sub-floor ridges, and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

B. Apply, trowel, and float filler to leave smooth, flat and hard surface, as required to ensure that floor mated surfaces will be level to within 1/8 inch tolerance in 10 feet in any direction.

C. Prohibit traffic until filler is cured.

D. Thoroughly sweep and vacuum all surfaces and remove all foreign matter.

E. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Use largest floor mat widths to produce minimum number of seams. Small pieces of floor mat will not be acceptable.

F. Unroll floor mat for adjustment to environmental conditions at least 24 hours prior to installation.

## 3.03 INSTALLATION - MATS

A. Loose lay entry mat in accordance with manufacturer's written instructions.

B. Loose laid installation: Seam tape shall be seamed with traffic direction. Set seam centers on fixed panel between doors.

C. Run all floor mat in the same direction. Plan and install floor mat in all areas so that single pieces per area shall be used to the fullest extent possible. No seams will be permitted in areas which are 12 feet, or less, in width.

D. Make all seams in floor mating by back-cutting the floor mat on an angle so that the face yarn of abutting pieces intermingles, and provides a practically invisible transition at each seam location.

## 3.04 CLEANING

A. Daily clean work areas by disposing of floor mat scraps.

B. Clean and vacuum floor mat surfaces upon completion of the installation.

## 3.05 PROTECTION

A. Prohibit traffic from floor mat areas for 24 hours after installation.

END OF SECTION

SECTION 13 34 23

PRE-ENGINEERED CANOPY

(ADD ALTERNATE 2 & 2A)

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers furnishing of all labor, equipment and material necessary to design, fabricate, and erect the lighted fuel island canopy system. As indicated on the Drawings, the canopy footers shall be ADD Alternate 2, and the above grade canopy structure shall be ADD Alternate 2A.

1.02 RELATED WORK:

A. Section 33 56 13 - Aboveground Fuel Storage Tanks

B. Section 21 24 00 - Fuel Station - Fire Suppression System

1.03 QUALITY ASSURANCE:

A. The canopy system shall be pre-engineered by a manufacturer regularly engaged in the fabrication of canopy structures conforming to applicable codes and standards.

1.04 SUBMITTALS:

A. Shop Drawings

1. Submit shop and erection drawings, details, data sheets and other descriptive drawings and materials as required to fully describe the fabrication and erection of the canopy and verify conformance with this Contract Document per Section 01 33 23 SUBMITTALS. Canopy and footing design drawings stamped by a New York Structural Engineer shall be provided by the Contractor.

2. Anchor bolts and other embedded items in the concrete shall be indicated on the shop drawings.

B. Computations

1. Submit all computations and drawings signed and sealed by a registered Professional Structural Engineer fully licensed in the State of New York.

2. All loads and reactions shall be supplied by the canopy manufacturer.

1.05 GUARANTEES:

A. Upon completion of the canopy system, the Contractor shall furnish the Owner with two copies of the manufacturer's guarantee for the following items:

1. Material used in the canopy system shall carry a guarantee against defects in composition, design, and workmanship for a period of one year from the date of acceptance by the Owner.
2. The erection and installation of the canopy system shall carry a guarantee against defects in workmanship for a period of one year from the date of acceptance by the Owner.

1.06 WARRANTY:

A. Canopy shall come with a 1 year warranty for the canopy to be free of defects in materials, leaks, and workmanship for 1 year from date of shipment.

PART 2 - PRODUCTS

2.01 CANOPY SYSTEM:

A. The canopy shall be designed and manufactured by VFS, Superior Canopy, Austin Mohawk, Fashion, Inc., Steeltec, or approved equal.

2.02 DESCRIPTION:

A. The canopy shall be approximately 17-feet and by 40-feet with 15-feet minimum vertical clearance to the bottom of the canopy decking, as shown on the drawings. The canopy shall be supported by two structural steel tube columns and equipped with external downspouts and center gutters and adequate lighting as shown on the Electrical Drawings. The fascia height shall be 42-inches. The color will be chosen by the Owner.

2.03 BASIC PRE-ENGINEERED CANOPY DESIGN:

A. Structural Components

1. Columns:

a. Structural steel tubing shall be used.
b. Sized to meet or exceed specific project design load requirements.
c. Base plates: ASTM A36 structural steel plate with a minimum yield stress of 36,000 psi, 3/4-inch thick with continuously welded gussets per column side. Drainage collectors are sized a minimum of 4-1/4-inches deep using 10 gauge steel.
d. Top plates: ASTM A36 structural steel plate with a minimum yield stress of 36,000 psi. Plates shall be shop fabricated with pre-punched or pre-drilled bolt holes. No field drilling is allowed.

e. Provide each with electrical access openings, cover plates, and one (1-inch) electrical conduit coupling welded into the column.

2. Structural framing:

   a. Wide flange beams will be used.
   b. ASTM A992 Grade 50 structural steel with a minimum yield stress of 50,000 psi.
   c. Structural beams will be provided for full perimeter of canopy & mounted flush against the fascia.
   d. Structural steel shall be designed to provide a positive slope for drainage.

3. Structural Connections:

   a. Structural steel plates shall be used.
   b. ASTM A36 structural steel connection plates with a minimum yield stress of 36,000 psi.
   c. All framing members shall be shop fabricated for bolted field assembly. Field welding shall not be required.
   d. Domestic ASTM A325, high strength bolt holes shall be used.

4. Anchor bolts:

   a. Minimum 1-1/4-inches diameter by 30-inches long headed structural rod with nuts and washers or as recommended by manufacturer.
   b. ASTM A36 structural steel with a minimum yield stress of 36,000 psi.
   c. Minimum projection above footing shall be 8-inches finished threads.
   d. Double nuts and washers for each bolt shall be provided; one set to be used as levelers.
   e. Templates for setting anchor bolts shall be factory furnished a minimum 7/16-inch thick particle board or 18-gauge steel and shall be removed before setting column on foundation.
   f. Anchor bolts shall be threaded and protected by grease at the time of installation.

5. Cleaning and painting:

   a. All framing members and structural support columns, and other items requiring paint per manufacturer recommendations shall be cleaned to remove loose mill scale and other foreign matter. Cleaning process shall meet or exceed Steel Structures Painting Council Specifications (SSPC-3) for powered hand tool cleaning. After cleaning, all framing members will be given one shop coat of air drying red oxide primer. The primer coat thickness shall be a minimum of one mil. The Painting Contractor will provide a final coating(s) of paint to canopy components per manufacturer recommendations and in accordance with Section 09 91 00 PAINTING. Including but not limited to exposed steel, support columns, and

canopy framing. Paint color to be chosen by the Owner, per manufacturer recommendations.

B. Deck panels

1. Deck panels shall be 20 gauge steel panels, sized in accordance with manufacturer's recommendations. The Owner will choose the decking color, if requested; bronze decking will be provided.
2. ASTM A446 with a minimum yield stress of 50,000 psi having a G90 galvanized surface meeting ASTM A525.
3. Panels shall be fastened to the wide flange purlin beams with a beam clip that requires no "thru the panel" fasteners.
4. No splicing of deck panels shall be allowed.
5. Panels shall have a finish side coated with a full coat of polyester paint baked on over an epoxy primer. Reverse side shall be protected by a white wash coat baked on over an epoxy primer.

C. Fascia

1. Laminated Panels 42-inches high:

   a. 24 gauge steel sheet pan formed.
   b. G60 hot dipped galvanized, tension leveled and extra smooth on exterior face of panel.
   c. Factory pre-assembled, self-flashing.
   d. No exposed fasteners on bottom or exterior face.
   e. Panel core material: 2-inches thick virgin expanded polystyrene with nominal 1.0 to 1.5 PCF density.
   f. Panels shall have a finish side pre-coated with a full coat of factory applied polyester paint baked on over a full coat epoxy primer. Strippable film shall be factory applied to protect panel surfaces during manufacturing, shipping, and erecting.
   g. Panels shall extend below the limit of the flush mounted lights to control light spillover.

2. Fascia Attachments:

   a. All components shall be galvanized steel or aluminum.
   b. All fascia will be mounted to perimeter steel.

D. Accessories

1. Gutters shall have a finish side coated with a full coat of polyester paint baked on over an epoxy primer. Interior surface shall be protected by a white wash coat baked on over an epoxy primer. No trim caps top or bottom will be allowed.
2. Downspouts will be sized 4-inch x 3-inch heavy-duty aluminum. Downspouts shall be routed under the tank to discharge stormwater behind the tank onto the stone mulch area.

3. Hardware for gutter-to-deck panel fasteners shall be No. 12 x 3/4-inch long, self-drilling, carbon steel, cadmium plated screws with an integral hex head and neoprene sealing washer.
4. Sealants will be factory supplied and approved.
5. Universal Sign Boards will be provided on each column and include all safety information required by local, state and federal regulations, supplied & installed by General Contractor.

E. General Notes:

1. All materials are new and without defects, which would lessen quality of work.
2. All materials will conform to the requirements, tolerances, etc. of the latest editions of the AISC Manual of Steel Construction, AISI Specifications for the Design of Cold Formed Steel Members, ASTM Standard Specifications for General Requirements for rolled steel plates, shapes, sheets, and bars for structural use, and AWS for welded connections.
3. Canopy erection drawings are furnished at time of shipment. Piece marks are included to facilitate easy field identification of all major parts.
4. Anchor bolt setting plans will include a recommended footing size. All changes in grade will be addressed by footing burial depth. All canopy columns will be the same length.
5. All A325 bolts shall be tightened by the turn-of-nut method.
6. The manufacturer's representative will be present for canopy unloading, torque test and final inspection.
7. All A-325 bolt's to be galvanized & all TEK fasteners to be stainless.

F. PVC Pipe and Fittings:

1. Unless specifically designated otherwise, PVC pipe and fittings shall be Schedule 80 with solvent weld joints as specified herein.
2. PVC Schedule 80 pipe shall conform to ASTM D1785.
3. PVC Schedule 80 socket fittings shall conform to ASTM D2467 and PVC Schedule 80 threaded fittings to ASTM D2464.
4. Rigid PVC used in the extrusion of the pipe and fittings shall be Type 1, Grade 1 compound as stated in ASTM D1784 with a cell classification of 12454B.
5. Both pipe and fittings shall be the product of one manufacturer.
6. Solvent cements shall conform to ASTM D2564.

2.04 DESIGN CRITERIA:

A. The design criteria for the canopy, including wind, uplift, roof, snow, and dead loads and soil bearing capacity, shall meet New York building code requirements. The soil bearing and lateral capacities shall be in conformance with the geotechnical report written by Terracon in October 2020. See Section (00 31 32) for instructions on how to obtain geotechnical report. The snow load shall take into account the entire fascia area being filled with snow, plus a suitable allowance for snow drift. Loading shall also take into account

equipment loads including the fire suppression equipment and personnel installing the canopy.

B. Each member shall be designed to withstand stresses resulting from combinations of loads that produce maximum percentage of actual to allowable stress in that member, as prescribed in MBMA "Recommended Design Practices Manual."

PART 3 - EXECUTION

3.01 FABRICATION

A. All Components of the services station canopy shall be fabricated in accordance with manufacturer's requirements.

3.02 INSTALLATION

A. Complete erection of the service station canopy shall be by the manufacturer or an authorized representative of the manufacturer. The authorized representative shall be skilled in successful erection of canopy systems.

B. The canopy shall be properly grounded to ensure that the canopy and equipment housed under are protected from lightning damage. The canopy shall be protected from lightning in accordance with local, state, and federal building codes.

C. All electrical materials and installations for satisfactory performance of the herein specified system(s) shall be run in accordance with manufacturer's recommendations and applicable code requirements.

D Contractor shall provide electrical service and connections and shall furnish and install all wiring for the system whether or not indicated on the Drawings, to guarantee a complete operational system.

E. The specifications above provide the minimum standards only and shall be upgraded as needed. The general components of the canopy system are described in the specifications and the drawings, the Contractor shall provide all labor, equipment, and materials needed for a complete and operable system in accordance with Local, State, and Federal building codes/regulations and manufacturer recommendations.

END OF SECTION

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SECTION 13 34 43

FRAME SUPPORTED MEMBRANE STRUCTURE

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specifications, apply to this Section.

B. The specification is general in nature and scope and shall not be construed as to limit the work; the Contractor shall provide a complete and operable system. The membrane-covered frame salt storage structure shall match the Drawings and Specifications in materials, appearance, configuration and details, as specified herein.

C. It is the intent of these specifications that the bidder shall include all labor, materials, equipment, services and transportation for the manufacture and supply of the membrane-covered frame structure, including exterior and interior finishes as shown on the Drawings. All buildings shall be as dimensioned with all features and quantities as shown in the Contract Documents.

D. All workmen shall be skilled and qualified for the work they perform. All materials used, unless otherwise specified, shall be new and of the types and grades specified.

E. Building manufacturer shall be performed under factory conditions in a plant specifically arranged for this type of work. Manufacturer shall provide all necessary operations for packing and shipping, and provide technical information to the contractor for adequate space planning, equipment and personnel for the assembly and installation of all major components of the building.

F. The Contractor shall be responsible for obtaining and paying for building permits and approvals as needed to provide a complete and operable system.

### 1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

B. Design, fabricate, ship, and erect complete frame supported membrane structures, including but not limited to primary framing, supplemental framing for building components (including, but not limited to, lighting and electrical panel), bracing, fabric membrane, gable end louvers, framed openings for louvers, precast concrete block foundation/push wall system, connections to concrete block foundations/walls, and interior wood protection wall as described herein and as shown on the Drawings.

C. Hot-Dipped Galvanized, Rigid steel frame supporting membrane covered roof and wall

structure of the type described herein:

1. The structure must provide a minimum clearance of 13-feet from top of wall within 3-feet of inside edge of foundation. Building must provide an envelope at least 27-feet tall by 18-feet wide in the middle of the building to allow for dumping inside.
2. Flat gable end on both walls with two (2) 3-foot x 3-foot aluminum passive vents or as required by Manufacturer
3. Open end of structure shall be fully open as indicated in the drawings

D. Related Work: The following items are related to the work of this Section and are specified elsewhere:

1. Section 03 48 46 - Precast Concrete Block
2. Division 0 through 41 Specifications

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Engineer, design, fabricate and erect the frame supported membrane structure to withstand self-weight, attachment loads and superimposed loads from wind, snow, seismic and to resist in-service use conditions that the building will experience, including exposure to the weather.

1. Engage the services of a Professional Structural Engineer, registered in the State of New York, to provide the designs required for the work of this Project.

B. The membrane shall be tensioned over the framework. The interior of the structure below the main trusses shall be clear span free of any structural support members and shall provide unobstructed floor space. No exterior purlins, guy ropes or cables shall be used for anchoring the structure unless approved by the Owner.

C. Applicable Building Code:

1. International and New York State State Building and Fire Safety Codes – current editions.

D. Applicable Design Code:

1. For steel framing: AISC Specification for Structural Steel Buildings. Allowable Stress Design and Plastic Design - 1989.
2. For aluminum framing: SAS 30 Specification for Aluminum Structures.

E. Building nominal dimensions shall be as shown on the Drawings

F. The building will be utilized for salt and sand storage.

G. The structure shall be capable of being assembled, operated and dismantled in all ambient temperatures between -20 °F and 120 °F, and of accepting differential settlement of up to 2.5% between truss positions.

H. All materials used in the structure shall be new, without defects and free of repairs. The quality of the materials used shall be such that the structure is in conformance with the performance requirements specified herein.

I. The building shall be designed to accommodate differential settlement as indicated above, the building will be installed on a concrete block foundation as shown on the Drawings. The sway and cross bracing cables shall be adjustable to accommodate differential settlement as needed. In addition, the base plate/mounting hardware for the trusses at the interface with the concrete block wall shall be designed to be raised up by inserting additional plates (or other means) in order to accommodate differential settlement. The adjustable base plate/mounting hardware shall be coordinated with and approved by the Engineer.

## 1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications, details, certified product test results, installation instructions and general recommendations as applicable to building components and the complete building system.

B. Shop Drawings: Submit drawings consisting of structural framing, steel erection and layout plans, clearance diagrams, framed openings, fabric membrane specifications, block wall foundation design, and other system components and accessories that are not fully detailed or dimensioned in manufacturer's product data. Shop drawings shall be signed and sealed by a Structural Engineer registered in the State of New York, hired by the contractor, herein referred to as the Structural Engineer.

C. Membrane Color Samples for color selection: Submit actual samples of membrane (min 12'x12") in the full range of available standard colors for review and selection by the Engineer and the Owner – Approval of the membrane material submission shall not indicate full approval until color samples have been submitted, reviewed and approved.

D. Anchorage Plans: Submit anchorage plans showing the following:

a. Block Wall Foundation overall dimensions
b. Anchorage locations
c. Anchorage materials and details

E. Submit any proposed modifications to the foundation layouts and/or dimensions indicated on the Drawings to accommodate the specific requirements of the building manufacturer and/or of the site. The foundation wall/push walls shown on the Contract Drawings are diagrammatic only. The Contractor is responsible for providing additional wall buttresses (quantity and sizes) as required to meet the design criteria included in these documents at no additional cost to the Owner. This requirement will also apply to the need for additional blocks to accommodate changes in grade around the structure foundation. Manufacturer/Supplier shall verify all grades on site and shall coordinate with the General Contractor to accommodate grade changes.

## 1.05 QUALITY ASSURANCE

A. Qualifications:

1. Erector: The erector shall have at least five (5) years' experience of erecting frame supported membrane structures and shall be qualified as follows:
    a. Authorized in writing by manufacturer qualified to erect their products.

2. Manufacturer: A manufacturer who has regularly engaged in the design and fabrication of frame supported membrane structures under present name for a period of five (5) years minimum with designs by registered engineers in the employment of the building manufacturer.

3. Welder, Tacker and Welding Operation Qualifications: Use welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform type of work required.

4. The manufacturer and erector shall maintain a quality control program in general accordance with the AISC Code of Standard Practice.

B. Design Certification Letter: The design of the structural framing, including connections and anchorage, along with the concrete block wall foundation/push wall system shall be certified by a Professional Structural Engineer, registered in the State of Massachusetts, hired by the contractor (i.e., the Structural Engineer). The Structural Engineer shall submit a design certification letter indicating that the fabric structures and concrete block walls/foundations have been designed as an integrated system and that both the wall/foundation and fabric structure, meet all applicable codes including, but not limited to, the International and Massachusetts State Building and Fire Codes. The wall shall serve as a "push-wall" to facilitate sand and salt loading operations, and shall be designed to not slide or "push- out" during operations.

C. Testing and Inspection:

1. Refer to Section 01 45 23 Structural Tests and Inspections for testing requirements which will be administered by the Owner.

1.06 REFERENCES

A. American Institute of Steel Construction:

1. AISC Specifications for Structural Steel for Buildings. Allowable Stress Design and Plastic Design – 1989.
2. AISC S326-78 Design, Fabrication and Erection of Structural Steel Buildings
3. AISC S329-85 Structural Joints Using ASTMA325 or A490 Bolts.

B. American Society for Testing and Materials:

1. ASTM A36 Structural Steel.
2. ASTM A123 Standard Specification for Zinc (Hot Dip

Galvanized) Coatings on Iron and Steel Products

3. ASTM A307 Carbon Steel Externally and Internally Threaded Standard Fasteners.
4. ASTM A325 High-Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.
5. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
6. SAS 30 Specification for Aluminum Structures
7. ASTM A563 A-89 Carbon and Alloy Steel Nuts
8. ASTM A687-89 High-Strength Non-Headed Steel Bolts and Studs

1.07 DELIVERY, STORAGE AND HANDLING

A. Store materials above the ground surface on platforms, skids, blocking or other supports.

B. Protect from exposure to conditions that produce rust, or allows dirt or debris to collect on surfaces of framing or fabric membrane.

C. Handle components such that no parts are bent, broken, or otherwise damaged and avoid damage to other material and work.

D. The main structural trusses shall be two-dimensional trusses which nest tightly together in order to minimize shipping and storage volume.

1.08 WARRANTY

A. Manufacturer shall submit applicable warranties and/or certifications for the product to the Owner through the Engineer. Identify available warranties and submit sample of warranties along with Bid.

B. Manufacturer shall provide a 10-year minimum warranty for the fabric membrane including all attachment hardware, and a 15-year minimum warranty on the steel components of the building.

C. Include costs for above stated warranty and certificates in the cost of the frame supported membrane structure.

1.09 DESIGN CRITERIA

A. The building shall occupy the area identified on the Contract Drawings and be placed on top of a precast concrete block wall system as identified on the Contract Drawings.

B. The structure shall be designed in accordance with appropriate standards using methodology from ASCE 7-98 as an equivalent to SECTION 16 of the International, National, Standard and Uniform Building Codes; using load cases as per Section 2.3 Combining Factored Loads Using Strength Design, when located in the United States.

C. Primary and secondary framing shall comply with current issues of AISC, AISI and ASTM specifications.

D. The structure shall meet all applicable codes including the current International and New York State Building and Fire Safety Codes. In accordance with International and New York State Building Codes the foundation wall and structure shall support the appropriate roof live load, dead loads, equipment loads, wind load/speed, snow loads, and any other applicable loads/requirements. The following is a summary of the applicable codes. Contractor is responsible for confirming that these loads meet the current International and New York State Building Code load requirements as applicable:

1. Building Occupancy Category I
2. Roof Live Load 5 PSF, Collateral Load 8 PSF
3. Snow Load
    a. Ground Snow Load, Pg 50 PSF
    b. Flat Roof Snow Load, Pg 42 PSF
    c. Drift Loads Shall Be Applied Where Applicable
    d. Exposure Factor, Ce 1.2
    e. Load Importance Factor, Is 0.8
4. Wind Design Data
    a. Basic Wind Speed, V=100 MPH
    b. Importance Factor, Iw=1.15
    c. Exposure Category, B
5. Earthquake Design Data
    a. Seismic Importance Factor, Is 1.25
    b. Mapped Spectral Response Accelerations SS 0.04G, S1=0.168G
    c. Seismic Design Category B
    d. Site Class D
    e. Spectral Response Design Accelerations SDS 0.267G, SD1 0.112G

## PART 2 - PRODUCTS

### 2.01 GENERAL

A. All materials shall be new, without defects, free of repair, and meet or exceed the physical requirements of the design and fabrication processes.

B. The manufacturer shall maintain test reports on material inventory from which building components are fabricated.

C. Structures shall be an arch type system with minimum nominal clearance as identified on the Contract Documents. Structure shall be mounted on the top of the precast blocks to avoid impact with vehicles and shall include all block wall support accessories. All plates and connections shall be hot dipped galvanized. Structure shall include fabric membrane over the top (roof) of the structure and the back wall.

D. Frame Supported Membrane Structure Manufacturers:

1. Calhoun Superstructures, Iron Horse Structures Authorized Representative, Fran Burke, Phone: (978) 430-6716
2. Legacy Building Solutions, Dynamic Building Systems Authorized Representative, David Murphy, Phone: (978) 282-1802
3. RUBB Building Systems
4. Sprung Instant Structures

or Approved Equal

Even though a manufacturer is listed above, they must still be able to provide the fabric structure as indicated in the Contract Documents.

E. All individual parts or bundles and packages of identical parts are to be clearly marked for identification. The shipping document shall list the description, quantity and piece mark of the various parts, components and elements.

F. The building system materials shall be delivered to the project site during hours identified in the Contract Documents. Installation contractor will provide adequate workmen and equipment to promptly unload, inspect and accept material delivery.

G. The installation contractor shall be responsible for unloading, field storage, protection and transfer to the work area of all materials and equipment required to perform the work. At no time shall materials be dropped, thrown or dragged over the transport equipment or the ground.

2.02 STRUCTURAL FRAMING

A. All components of the structural framework shall be fabricated from hot dipped galvanized steel to resist corrosion. The main structure shall consist of welded truss arches with parallel tube chords separated by tube webs (U or C shaped only, round webbing not allowed). Truss sections shall be manufactured and post dip galvanized to ensure proper protection on the inside as well as the external surfaces. Truss shall be manufactured of a cold-formed and induction welded modified grade carbon steel, providing a finished tubular product with exceptional mechanical and corrosion resistant properties. The size of the truss components shall be determined by the Structural Engineer to meet the load requirements identified herein. All dimensional tubing tolerances are in accordance with ASTM 500, Section 10. All steel tubing used in the structure must conform to ASTM A568, ASTM A1011 and G40.21 350W. Finished steel tubing must have the following minimum structural and mechanical properties of ASTM A500/G40.21: Gr. B with minimum yield stress, Fy = 42 ksi and tensile stress, Fu = 58ksi. All steel flat bar, cross rods and other steel components shall be fabricated and then hot dipped galvanized from material having the minimum structural and mechanical properties of (ASTM 44W): Tensile: 50 KSI and Yield: 44 KSI

B. Purlin Bracing shall provide for structural stability and to provide for installation of accessory items, the main structural trusses shall be laterally braced by tubular purlins at intervals required by the truss design. All purlin locations shall brace both inner and outer truss chords. To provide for structural stability and to provide for installation of accessory items, the

main structural trusses shall be laterally braced by load bearing purlins at intervals required by the truss design.

C. Wind and Frame Bracing - The structure shall be appropriately stabilized with wind bracing cable as well as any required secondary node restraint assemblies so as to efficiently transfer wind and snow induced stresses to the foundation/anchoring system. Cable diameter for main wind bracing shall be a minimum of 5/16-inch diameter and larger if so required. The structures shall be designed to allow for "X" bracing early during erection to allow for permanent stability of the frame during installation.

D. Connecting Joints - Connections between primary structural elements shall be designed so as to transfer the compressive and tensile forces present in a given joint. A minimum of Grade 5 bolts shall be used at each truss chord joint. The minimum number of bolts shall be determined by the Structural Engineer to meet the Building Code loading requirements. Primary axial steel, secondary purlins, and end wall frame connections shall be made with a minimum of Grade 5 hex bolts, carriage bolts and self-drilling screws. Connection of truss frame to foundation shall be a pinned type connection to reduce member forces in the truss. Trusses shall be mounted to the top of the precast concrete block walls. Block walls shall be provided with proper support accessories as recommended by the manufacturer to support the structure and the existing grades.

E. Ancillary Systems - The structure shall be designed to readily accommodate ancillary systems such as lighting, sprinklers, HVAC, insulation systems, etc.

F. Primary framing shall consist of manufacturer's standard sections to match profile shown in the Contract Documents.

G. Framing shall consist of hot-rolled steel, fabricated steel truss sections, or extruded aluminum sections.

H. Bolts for primary framing field connections for steel shall be hot dip galvanized high strength bolts conforming to ASTM A-325. Bolts subject to extreme stress and wear shall be Grade 5 bolts and plated/galvanized or upgraded with JS500 corrosion resistant finish. All bolts shall be installed and securely pre-tensioned so as the prevent change in tightness. Those subject to removal or adjustment shall not be swaged, peened, staked or otherwise installed.

I. Structural Tubing: Comply with ASTM A 500.

J. All structural steel framing and fasteners shall be hot dip galvanized after fabrication per ASTM A123.

K. Manufacturer shall provide all components necessary for the foundation/anchoring system and shall provide stamped plans by a Massachusetts Registered Professional Structural Engineer for the foundation/anchoring design.

L. All steel tube components, trusses, purlins and fastening tubes shall be coated on the exterior with a corrosion resistant finish material providing a corrosion resistance of 2000 hours tested in accordance with ASTM B 117-90; with a 100% zinc based organic coating applied to the interior.

M. Provide all standard manufacturer recommended hardware with the appropriate corrosion protection.

N. The membrane shall be tensioned with load rated hardware which is plated/hot dip galvanized so as to prevent corrosion. Hardware shall allow full and free rotation at the foundation connection to avoid fatigue failure of threaded assemblies. The membrane shall be tensioned with load-tested tie-down belts. Main and wind bracing cable assemblies shall be manufactured to the required length and press swaged with metal sleeves. The cables are manufactured using preformed galvanized "aircraft" cables, sized with appropriate safety factors. Non-structural fasteners such as wood screws, self- drilling screws, etc., shall be of standard commercial quality.

O. The Manufacturer and Contractor shall provide supplementary framing as needed to accommodate additional building features including lights and louvers.

P. The main structural roof trusses shall allow for installation of electrical and mechanical equipment based on collateral loads.

2.03 FABRIC MEMBRANE

A. The membrane shall be UV stabilized, flame retardant coated HDPE fabric meeting New York State Building Codes for a noncombustible membrane structure or other approved membrane covering. The roof, side walls, end walls and all connecting sections shall be weather tight. In order to provide for a good finished appearance and to ensure weather tightness, the membrane shall be assembled and tensioned, in a manner to minimize wrinkles in hot and cold temperatures.

B. The structure shall be clad with a fire retardant UV stabilized waterproof membrane with a base HDPE material and an LDPE coating, free of defects, manufactured by an approved and reputable supplier with demonstrated long-term performance. Laminated materials are not acceptable for use on the outer weather membrane. The coated membrane fabric shall be waterproof and free from defects. All roofs, end walls and connecting sections shall be weather tight. The material must be UV stabilized and flame retardant, must carry a minimum ten year manufacturer's warranty on all components of the building including, but not limited to, roof, side, and end walls and must have life expectancy of 15 to 20 years. The minimum fabric specification is as follows:

1. Minimum Weight: 12.1 oz/sy ± 5% with minimum base fabric weight, finished thickness, grab tensile strength, tongue tear, cold crack resistance meeting or exceeding Fabreene Industrial Synthetic Fabrics Type P708WW, NovaShield II with ArmorKote Type FRU88X-6, or equal.
2. Coating Thickness: 3.9 mils average, each side
3. Finished Thickness: 24 mils (ASTM D-5199)
4. Grab Tensile Strength: Warp 414 lbf/Weft 446 lbf (ASTM D-751)
5. Strip Tensile Strength: Warp 468lbf/2in/Weft 504lbf/2in (ASTM D882)
6. Tongue Tear Strength: Warp 94lbf/Weft 108 lbf (ASTM D-2261)
7. Flammability Class A (ASTME84-94)
8. Flame Resistance: 2 sec flameout (NFPA 701)
9. Flame Spread: 25 or less (ASTM E84)

10. Acceptable membrane suppliers include: Inertape, Fabrene, Hagihara, or approved equal. The membrane manufacturer should demonstrate a minimum of five years successful field experience with provision of polyolefin membrane cladding in use on similar or larger size structures of the type specified herein.

C. Membrane color shall be determined from all available standard manufacturer's colors. Manufacturer/Supplier shall submit samples of full range of standard colors for review. Manufacturer/Supplier shall not place order for membrane until membrane color has been reviewed and approved by the Engineer and the Owner.

D. The membrane shall form a continuous uninterrupted weather tight shell over the framework. In order to provide for a good finished appearance and to insure weather tightness, the membrane shall be assembled and tensioned, in a manner to minimize wrinkles in hot and cold temperatures. Horizontal stretch (warp direction) shall be maintained with belting. Vertical stretch (fill direction) shall be maintained with a belt and winch lock system. The membrane shall create a weather tight enclosure.

E. The membrane system shall be designed such that adjacent membrane cladding panels can be made weather tight using overlap flaps tensioned the full arc of the truss to the truss base plate. Adjacent membrane cladding covers shall be installed utilizing a belt and winch lock system and be tensioned both vertically and horizontally to prevent wear and abrasion. All membrane welded seams shall attain a minimum strength equal to 70% the membrane material.

F. The membrane cladding will be provided with a mechanical tensioning system that allows the membrane to be fully tensioned around the structure perimeter. The system will be designed such that the membrane can be tightly and neatly secured over the structural frame and the systems have a remaining range for adjustment.

The building design will make allowance for the design tension and seal of the membrane material around doors, ventilation and other openings as well as around the structure perimeter below the main tensioning system and the roof of the existing office building. This seal shall provide a neat and finished appearance and eliminate any loose membrane cladding that could otherwise be damaged by flapping or abrasion. When a membrane base skirt is required, this shall be supplied and attached at the base perimeter to allow a reasonable seal against air and water intrusion.

G. The membrane shall not be designed to function as a structural member such that, should any damage to or penetrations of the membrane occur, the integrity of the structural framework would be affected.

H. The membrane shall be installed to provide a weather tight seal against the foundation wall.

I. Manufacturer's standard membrane or rigid gutters and rigid downspouts (leaders) shall be provided and coordinated with sub-surface drain connections (by others), as shown on the Drawings.

J. All penetrations shall be flashed per the manufacturer's recommendations for a weather tight system.

## 2.04 BLOCKWALL/FOUNDATION

A. The Manufacturer's Structural Engineer shall provide base reactions for foundation design along with a copy of the anchoring requirements, the anchor bolt plan, truss and leg truss line locations.

B. The final design of the anchor bolt diameters, quantities and embedment lengths are the responsibility of the Manufacturer's Structural Engineer. Any changes required to anchor bolt diameters and quantities must be prior to manufacturing. The building shall be placed on a precast concrete block wall as shown on the drawings. Alternate foundation systems may be proposed by the building manufacturer and will require the stamped approval of the Structural Engineer and shall come at no additional cost to the Owner. The block wall and foundation shall be designed by the Structural Engineer, and the blocks shall meet the requirements of Section 02840 pre-cast concrete block. The inside of the foundation must be treated to inhibit damage to the concrete from the salt and must be completely covered with 23/32-inch pressure treated plywood. The plywood shall be bolted firmly and flush to the top of block wall as approved by the Engineer. All block horizontal joints must be watertight and secured using an adhesive (BASF Sonneborn Premium Adhesive or approved equal) and all vertical joints must be watertight and sealed with weatherproof caulking (BASF Sonolastic NP 1, or approved equal). In addition, the interface between the bottom of the block wall and the pavement shall be sealed to be watertight using a bitumastic sealing compound in accordance with manufacturer's recommendations, and as approved by the Engineer.

C. Each block in the pre-cast concrete block wall/foundation shall be bolted together on the exterior of the block wall using galvanized steel plating and bolts in accordance with the Structural Engineers recommendation. The plating/bolting of the blocks shall be such that all of the blocks will be bolted/plated together to form one connected foundation/block wall system to allow the wall/building to settle while still maintaining a continuous integrated wall/block system.

The walls shall consist of minimum 4000 psi blocks, 24 inches W x 24 inches H in either 2-foot, 4-foot or 6-foot lengths to create a foundation wall with a minimum of 6 inches below grade. Blocks shall be formed with an interlocking key system consisting of a minimum of two (2) tapered knobs with minimum dimensions of 2 5/8" high and 7 5/8" diameter. Blocks shall have beveled edges and shall have openings on the bottom sized to interlock with knobs of other blocks when stacked. Blocks shall contain reinforcement as recommended by the manufacturer.

# PART 3 EXECUTION

## 3.01 INSPECTION

A. Examine the building interface conditions for conformance with approved anchorage plans. Do not proceed with the work until unsatisfactory conditions have been corrected.

## 3.02 STRUCTURAL FRAMING

A. Erect the building structure in accordance with approved erection drawings and instructions.

B. Provide temporary guys and bracing for squaring, plumbing, and securing the buildings until completion of erection and installation of permanent bracing.

C. Erection tolerances shall be in accordance with manufacturer's recommendations.

3.03 FABRIC MEMBRANE

A. Fabric membrane shall be installed in accordance with erection drawings and instructions.

3.04 PROTECTION AND CLEANING

A. Clean all structural framing and fabric membrane of all dust, dirt and debris.

3.05 CODES

A. All work to be performed under the conditions of these specifications shall comply with the rules and regulations of all agencies having jurisdiction for this classification of construction, including Building, Fire, Welding, and Safety Codes.

3.06 WELDING

A. Welding shall be employed only when specified in the original design. Welders qualified and certified to the CSA standard W47.1. Division 2 shall perform welding in accordance with AWS D1.1 and AWS D1.3. All welded components shall be prepared/steel shot blasted prior to the finish coating of hot molten zinc applied to a minimum of 3 mils thick.

INSTALLATION

A. Contractor shall provide all equipment, materials, and labor as needed to provide a complete and operable system. All ferrous metal components of the system shall be hot dipped galvanized to prevent corrosion, in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 13 42 00

PRE-ENGINEERED METAL BUILDING

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Engineer, furnish and install the following:

1. Designed, pre-engineered and shop fabricated structural steel building frame.
   a. Shop primed primary, supplemental and miscellaneous metal framing, clips, and accessories with stainless steel screws and fasteners.
   b. Hot-dipped galvanized (G90) all secondary framing
   c. Hot dip galvanized (G90) primary, supplemental and miscellaneous metal framing, clips, and accessories
2. Insulated standing seam metal roofing panels
   a. Related flashings and running sheet metal work, for all non-specified locations in conjunction with the roofs.
3. Insulated metal wall panel including brake metal corner, base, jamb, head trim at vertical panels.
4. Framed openings in walls and roofs.
5. Gutters and downspouts, and metal downspout adapters/transitions.
6. Snow guards.
7. Roof and wall penetration seals.
8. Rooftop curbs for mechanical equipment.
9. Windows, translucent panels, doors and frames.
10. Secondary and supplemental steel supports for equipment and work of other sections including but not limited to: Mechanical, electrical and plumbing elements.
11. Entry canopy soffit metal panels.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and back-up materials.

B. Section 08 36 13 – SECTIONAL DOORS AND FRAMES

C. Section 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES.

D. Section 08 91 19 – FIXED LOUVERS: Furnishing and installing fixed and operable louvers and vents.

E. Section 09 91 00 - PAINTING: Interior finish painting of interior partitions and walls, within the pre-engineered building.

F. Division 21- FIRE PROTECTION

G. Division 22 – PLUMBING.

H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Rough-in utilities.

I. Division 26 - ELECTRICAL: Rough-in utilities.

1.03 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.

1. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
4. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
5. ANSI/SDI A250.8 – *R2008* (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
6. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
7. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
8. ASTM A36 - Structural Steel.
9. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
10. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
11. ASTM A325 - High Strength Bolts for Structural Steel Joints.
12. ASTM A386 - Zinc-coating (Hot-Dip) on Assembled Steel Products.

13. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
14. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
15. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
16. ASTM A501 - Hot Formed Welded and Seamless Carbon Steel Structural Tubing.
17. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
18. ASTM A529 - Structural Steel with 42,000 psi (290 MPa) Minimum Yield Point.
19. ASTM A572 - High Strength Low Alloy Columbium Vanadium Steel of Structural Quality.
20. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
21. AWS A2.0 - Standard Welding Symbols.
22. AWS D1.1 - Structural Welding Code.
23. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).
24. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
25. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
26. SSPC - Steel Structures Painting Council.
    a. Society for Protective Coatings:
        1) Surface Preparation Specifications:
            a) SSPC – SP 1 – Solvent Cleaning.
            b) SSPC – SP 2 – Hand Tool Cleaning.
            c) SSPC – SP 3 – Power Tool Cleaning.
        2) Surface Preparation Specifications:
            a) SSPC-PQ 1, Shop, Field and Maintenance Painting.
    b. Federal Specifications:
        1) TT-P-645, Primer, Paint, Zinc-Chromate, Alkyd Type
27. All applicable federal, state and municipal codes, laws and regulations for exits.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. MBMA – Metal Building Systems Manual.

C. Definitions:

1. Bay Spacing: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured perpendicular to end wall (outside face of end-wall girt).
2. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
3. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).

4. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame, or knee).
5. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
6. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.
7. Collateral Loads: Dead loads other than those of the metal building system, including, but not limited to: sprinklers, mechanical systems, electrical systems, ceilings and suspended equipment
8. Terminology Standard: Refer to *Metal Building Systems Manual* as published by Metal Building Manufacturer's Association (MBMA) for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
2. Submittal of prefabricated engineered building shop drawings shall be coordinated with existing concrete foundations and footings.

B. The metal building system shall be designed by the manufacturer as a complete system. All components of the system shall be supplied by or compatible with the metal building system provided by the manufacturer. The building systems shall be provided from a "single source manufacturer" with all required warranties for the complete building system originating from the single source manufacturer.

C. Refer to the Structural Drawings for Design Loads and Design Criteria.

D. All design required under this Section shall be performed by a Professional Structural Engineer registered in the State of New York

E. Exterior metal wall and roof panel assemblies and supports shall be designed for the specified wind and seismic loads. Refer to Structural Drawings for Design Loads.

1. Roof loading shall include provisions for collateral loading for future solar panels, refer to Structural Drawings.
2. Roof loading and roof panels shall be designed to accommodate fall protection system directly fastened to standing seams of metal roof panels. Coordinate with fall protection manufacturer/engineer. Provide supplemental steel and/or increase gauge of roof panel as necessary to meet loading requirement at no additional cost to Owner.

F. Design and provide special framing for the support of architectural features including, but not limited to overhead doors and personnel doors.

G. Design, detailing and erection shall comply with the applicable standards listed in 29 CFR Part 1926 – "Safety Standards for Steel Erection".

H. Sequencing:

1. Field Measurements: Verify that field measurements are as indicated on shop drawings.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
   a. Include data on profiles, component dimensions, fasteners, and sealants.
2. Shop Drawings:
   a. Shop drawings shall be submitted as a complete package for the entire prefabricated engineered building assembly as described herein. Partial submissions or submissions without a professional engineer's stamp and signature will be rejected.
   b. Elevations, plans and details: 1/8 inch scale elevations and plans, and large scale design details showing framing, and panel attachment methods (both roof and walls); and complete installation details.
      1) Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers (if required), and both live and dead design loads.
      2) Roof and wall panels: Indicate wall and roof system dimensions, panel layout, construction details, anchorages and method of anchorage, method or installation. Show layouts of panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory-assembled, and field-assembled work.
      3) Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
      4) Indicate all connections and interface with adjoining work.
   c. Anchor-Bolt Plans: Indicate anchor bolt locations, settings, sizes and material, column base plate dimensions, sizes, etc. and column base reactions at foundation connections. Submit in advance of erection drawings. These are to work for the existing concrete slab and piers that have been installed. See attached drawings in specifications for reference.
   d. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
   e. All shop drawings shall be stamped and signed by a professional structural engineer registered in the State of New York
3. Selection Samples:
   a. Sample card indicating manufacturer's full range of colors available for selection by Engineer.
   b. Provide additional samples as requested by Engineer for initial selection of colors and finishes.

4. Verification Samples:
   a. 12 by 12 inch samples of roof and wall panels, illustrating material and finish.
      1) Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
   b. Trim and closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
   c. Vapor retarders: 6 inch (150 mm) square samples.
   d. Accessories: 12 inch (300 mm) long samples for each type of accessory.

5. Certificates:
   a. Certificate of compliance from galvanizer: Submit notarized certificate of compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed, zinc coating thickness as specified.
   b. Shop finished products: Manufacturer's written certification stating that metal building components and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section, and that shop finishing has been performed as specified.
6. Delegated Design Submittals:
   a. Furnish complete design analysis for all structural components of the prefabricated metal building. The structural engineer shall be registered in the State of New York and shall state in writing that the structural framing and building components are in compliance with the criteria set forth in the specifications and as indicated on the Drawings.
   b. Provide manufacturer load tables indicating the selected panel material, configuration and thickness meets the design requirements for the spans shown
7. Manufacturer’s Instructions: Manufacturer’s written installation instructions indicating preparation requirements, assembly sequence, special procedures, and field conditions requiring special attention.
8. Source Quality Control Submittals:
   a. Submit list of installations completed within the last three years, include all contacts and references.
9. Qualification Submittals:
   a. Installer/Applicator: Manufacturer's written certification stating that erector is qualified, licensed, authorized and approved to install the building system in accordance with manufacturer's requirements.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 – PROJECT CLOSEOUT.
   1. Bonds and Warranty Documentation:
      a. Manufacturer’s warranties and guarantees as specified elsewhere herein this Section.
   2. Record Documentation: Submit accurately record actual locations of concealed utilities.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: The company manufacturing the products specified in this Section shall have a minimum of five (5) years' experience in the manufacture of steel building systems. The manufacturer shall be certified under the American Institute of Steel Construction's Category MB Certification Program.
2. Erector: The Erector shall have at least five (5) years' experience of erecting steel building systems and shall be authorized, in writing, by the manufacturer as being trained and qualified to erect their products. The erector shall also be knowledgeable of the AISC "Code of Standard Practice for Steel Buildings and Bridges" and the Metal Building Manufacturer's Association "Metal Building Systems Manual".
3. Welder, tacker and welding operator qualifications: Use welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform type of work required. Submit verification that welders are AWS D1.1 and D1.4 qualified within the previous 12 months.
4. The metal building manufacturer and erector shall maintain a quality control program in accordance with the AISC Code of Standard Practice. The erector shall be qualified by the building manufacturer to install and maintain the warranties applicable to this specification. All erectors shall have 10 hour OSHA training and have all personal protection equipment required to perform the work in accordance with all safety requirements and regulations in force.
5. The roof system shall carry a UL (Underwriters Laboratories) wind uplift resistance classification of 90.
6. Licensed Professionals: Design Work under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of New York.

B. Testing and inspection:

1. Refer to Section 01 45 23 - STRUCTURAL TESTS AND INSPECTIONS and comply with additional requirements specified therein. The inspection and testing services provided by the Independent Testing Agency do not relieve the Contractor from the responsibility to provide supervision, testing, inspection, and quality control in order to assure conformance with requirements specified herein and elsewhere in the Project Manual.

## 1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not fabricate or deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
    a. Stack and cover metal building materials with suitable weather-tight covering.

C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Engineer specifically authorizes correction thereof and usage on project.

1.08 WARRANTY

A. Manufacturer Warranty:

1. Provide 25-year warranty which shall include coverage for exterior prefinished surfaces to cover prefinished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.

B. Special Warranty:

1. Provide project specific 20-year unconditional warranty or bond which shall include coverage for weather tightness of roof and wall enclosure after installation.
2. Include costs for the above stated warranties and certificates in the cost of the metal building system.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Ceco Building Systems, Columbus, MS.
2. American Steel Buildings, Murfreesboro, TN.
3. Eagle Steel Buildings, Tyler, TX.
4. Butler Manufacturing Company, Kansas City, MO.
5. MBMI, Inc., Delray Beach, FL

2.02 PERFORMANCE/DESIGN CRITERIA

A. Deflection Limits: Exterior wall and roof system to withstand imposed live and wind loads with maximum allowable deflection of span (L = Span length), refer to Structural Drawings.

B. Thermal resistance (R-Value): The following listed R-values represent the minimum required insulation value as calculated for continuous insulation coverage over the structure:

1. Wall system R-value 28.8 minimum.
2. Roof system R-value 36 minimum.

C. Members to withstand progressive snow and live loading, and design loads due to pressure and suction of wind calculated in accordance with NY State 2020 Building Code.

1. Refer to Drawings for design loading.
2. Underwriters Laboratories (UL) Class 90 rating: The roof system shall carry a UL wind uplift classification Class 90 rating as determined according to UL 580 Tests for Uplift Resistance of Roof Assemblies.

3. FM Global (Factory Mutual) - The roof system has been tested according to FMRC Standard 4471 and approved as a Class 1 Panel Roof.
4. Design structural steel sections in accordance with AISC, "Specification for the Design, Fabrication, and Erection of Steel Buildings".
5. Design light gage cold formed structural members in accordance with latest edition of AISI, "Specifications for the Design of Light Gage Cold FormedSteel Structural Members".
6. Welding shall comply with AWS Standard No. D1.1.

D. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to the following temperature ranges:
1. Ambient temperature range: 120 deg F (67 deg C).
2. Material surfaces: 180 deg F (100 deg C).

E. Structural Steel Design: All structural mill sections or welded-up plate sections shall be designed in accordance with the 2005 edition of AISC "Specifications for Structural Steel Buildings", and all cold-formed steel structural members shall be designed in accordance with the 2004 edition of AISI "Specifications for the Design of Cold Formed Steel Structural Members".

## 2.03 DESCRIPTION

A. General Description:
1. Clear span rigid frame and roof truss system.
2. Primary Framing: Rigid frame of rafter beams and columns, braced end frames, end wall columns, wind and seismic bracing.
3. Secondary Framing: G90 galvanized, 8 inch nominal cold-formed steel girt framing and roof purlin framing for vertical panel installation.
4. Wall system: Preformed R 28.8, min factory foamed, metal panels of vertical profile.
5. Roof system: Preformed R 36 min. factory foamed, metal panels, standing seam.

## 2.04 MATERIALS

A. Framing:
1. Structural Steel Members: ASTM A36.
2. Structural Tubing: ASTM A500, Grade B.
3. Plate or Bar Stock: ASTM A529.
4. Anchor bolts: ASTM F1554, Gr. 36, Galvanized provided by the General Contractor.
5. High strength bolts, nuts, and washers: ASTM A325, galvanized to ASTM A153.
6. Welding: Comply with AWS D1.1; type required for materials being welded.
7. Primer: Manufacturer's standard gray oxide primer.
8. Grout: Non-shrink type, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 2,400 psi (17 MPa) in two days and 7,000 psi (48 MPa) in 28 days.
9. Wall girts and roof purlins shall be hot dip galvanized to G90 requirements.

B. Roof System:

1. General:

   a. System performance: UL 580, Class 90 rating for wind uplift.

   b. All panels shall be factory finished on both sides.

2. System Type: Insulated Roof Panels.

   a. To establish a standard of quality, design and function desired, Drawings and specifications have been based on a panel system as manufactured by Kingspan. Product: KingSeam Insulated Standing Seam Roof Panel system. Equivalent products of other manufacturers may be submitted for approval by the Engineer.

   b. Insulated Roof Panel:

      1) Configuration: 5" thick metal panels Formed with raised trapezoidal ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

         a) Profile: Mesa with trapezoidal ribs, non embossed.

      2) Minimum metal thickness: 24 gauge exterior face, 26 gauge interior face, galvanized, per ASTM A653, G90.

         a. Color: As selected by Architect from manufacturer's full range.

         b. Insulation: Continuous foamed-in-place, non-CFC polyurethane.

         c. Panel width shall be 40 inches.

         d. Panel length shall be one piece from ridge to eaves.

         e. Accessories: Furnish and install all accessories as necessary for a complete system.

3. Equipment curbs with integral crickets for rooftop mounted mechanical equipment:

   a. Standard equipment curbing, including but not limited to structural framing members, fasteners, gasketing, crickets, transition and closure pieces, flashing and insulation, as provided by the metal building system manufacturer.

   b. Materials and finish to match metal roof system.

4. Snow guards:

   a. Acceptable manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

      1) Alpine Snow Guards, Morrisville, VT, product: "ASG4025".

      2) Sno-Gem McHenry, IL, product: " 2" Gem Clamp with MEC Bracket" Clamp to Seam Snow Retention.

   b. Snow fence: Aluminum tube and bracket snow guard system, consisting of the following components:

      1) Aluminum snow guard brackets with (3) set screws per guard.

      2) Aluminum tubing, 1 inch outside diameter and .120 inch wall thickness.

      3) 3 inch long internal and concealed couplings.

      4) Aluminum ice flags (size, spacing and location as recommended by the manufacturer), end caps and end collars.

5) Finish: Match standing seam roof system.

C. Wall Systems:

1. General:

a. For limits of wall panels refer to Drawings.

2. Insulated Wall Panels (at exterior panel applications):

a. System Type: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kingspan or approved equal. Equivalent products of other manufacturers may be submitted for approval by the Engineer.

b. Insulated Wall Panel:

1) Configuration: Metal panels with concealed fasteners as follows:

a) Panel Type KS Series: 40 inch wide, 4 inch thick vertical.

2) Minimum metal thickness: 24 gauge exterior face, 26 gauge interior face, galvanized, per ASTM A653, G90.

3) Coatings, exterior.

4) Insulation: Continuous foamed-in-place, non-CFC polyurethane.

5) Panel width shall be 36 inches, panel thickness shall be 4 inches. Insulated wall panels shall have factory applied sealant at the interlocking, thermal break connection. All flashings, support angles, mastics, caulkings, and butyl compressive seals shall be installed per the manufacturers required installation manuals. All corners, eaves struts, rakes, and connections that have any voids shall have fiberglass insulation and or foam insulation installed to accomplish a continuous insulation system.

6) Panel length shall be one piece from base of building to top of wall at roof eave and rake lines for vertical panels, unless shown otherwise indicated on the Drawings. For horizontal panels, panels shall be as indicated on the Drawings and no longer than manufacturer's recommendations.

7) Accessories: Furnish and install all accessories as necessary for a complete system including but not limited to, panel closures, inside and outside corners, sill and head trim, roof termination trim, fascias, and soffits.

8) Panel trim materials, including, but not limited to base, jamb, sill, head, corners, butt joints, etc.: Aluminum brake metal.

a) All fasteners shall be concealed pre-painted to match the wall color.

D. Entrance Canopy Soffit:

1. Metal Ceiling Panel:

a. System Type: Flush soffit, Drawings and specifications have been based on Pac Clad or approved equal. Equivalent products of other manufacturers may be submitted for approval by the Engineer.

b. Product: 24 gauge steel flush/solid soffit panel, 1" thick, 12" wide.

c. Accessories: Provide manufacturer's standard matching "J" trim and accessories.

d. Color: As selected from Manufacturers full range. 30-year non-prorated warranty.

e. Meet ASTM E330 testing.

## 2.05 ACCESSORIES

A. Roof Supplemental Steel: Provide structural framing for support of supported equipment's and suspended equipment or wall systems framing into roof purlins as indicated on the Drawings.

B. Framed Openings: Provide structural framing for roof and wall openings to accommodate roof curbs, overhead doors, personnel doors, windows, and louvers.

1. Wall and roof openings shall be trimmed out and made weather tight by the Contractor. The Manufacturer shall supply trim components.
2. Hot dip galvanize structural steel channels and tubes at overhead doors, personnel doors and all other locations where secondary framing is in contact with base slab at exterior perimeter of the building.

C. Gutters and Downspouts: Manufacturer's standard including all offsets and 90-degree bends for downspouts. Gutters and downspouts shall be made from galvanized steel class G90. The Engineer shall select finish colors.

1. Downspout transition boot: Factory finished, 11 gauge, custom color to match downspout equal to Piedmont Pipe "Type SV".

D. Wall and Roof Penetrations: Manufacturer's standard offering to cut and seal wall and roof openings for miscellaneous flues, plumbing and electrical penetrations:

1. Contractor to coordinate roof openings, vents, plumbing and electrical penetrations with mechanical, plumbing and electrical drawings.
2. Roof penetrations shall not penetrate the standing seam of roof panels.

E. Roof openings shall be cut and sealed by the Contractor. Insulated roof curbs shall be supplied, installed and made weathertight by the Contactor. Sizes to be coordinated with mechanical drawings.

1. Roof curb installation shall be panel over curb flange on high side and panel under curb flange on low side.
2. Roof curbs to have a cricket on the high side. All roof penetrations shall be provided and installed by the Contractor and shall be incorporated in the weather-tightness warranty by the building manufacturer and the Contractor.

F. Louvers: Coordinate with Specification Section 08 91 19 – FIXED LOUVERS.

G. Snow Guards: Mechanically fastened to standing seams of metal roofing in two rows with spacing per manufacturer's recommendations or as indicated on the Drawings.

H. Accessories, including but limited to, roof curbs, sill angles, panel base metal closures, flashings, soffits, eave trim, gable trim, door side flashing, header flashing, fascia's and trim, shall be the manufacturer's standard offering and be made of galvanized steel class G90. Finish coatings shall be the same as the roof panels. Colors shall be selected by the Engineer.

## 2.06 FINISHES

A. Primary, secondary and supplemental structural steel.

1. Typical: Shop prime all steel components as specified herein.
2. Secondary Steel: Hot dip galvanize all steel components.

B. Exterior face sheet of insulated and uninsulated metal panel components and accessories, and exterior and interior faces of roof components and accessories: Pre- coated finish on galvanized coated (G90) steel.

1. Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:

a. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000 ".

b. Finish coating shall be manufactured as one of the following products:

1) Morton International; product "Fluoroceram"
2) PPG Industries Inc.; product "Duranar."
3) Valspar Corp., product: "Fluropon."

c. Prepare and prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.

d. Shop finish exterior wall panel surfaces and both sides of roof panels with one color coat, of polyvinylidene fluoride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.

1) On reverse side of exterior face sheet of insulated wall panels provide off-white washcoat.

e. Color and Appearance: Color shall be selected by Engineer from paint manufacturer's full range of colors (including metallic). The available library of all colors shall not be less than 16 colors.

C. Interior face sheet of insulated metal panel components and accessories: Manufacturer's standard two coat polyester system on the exposed side and 0.30 mil (minimum) non-color controlled wash coat primer on unexposed side.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.
2. Beginning of installation means acceptance of existing substrate and project conditions.

### 3.02 ERECTION - FRAMING

A. Erect framing in accordance with AISC Specification.

1. Bolt settings and other dimensions shall be held to a tolerance of plus or minus 3 mm (1/8-inch). Use templates or other gaging devices to assure accurate spacing of anchor bolts. Bolt field connections unless otherwise indicated on approved shop drawings.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated on approved shop drawings.

C. Set column base plates with non-shrink grout to uniform full plate bearing and to maintain established floor line elevation(s).

D. Do not field cut or alter structural members without approval of Engineer.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOFING SYSTEMS

A. Roof and wall coverings shall be installed in accordance with erection drawings and in strict adherence to manufacturer's instructions. Install all gaskets, joint fillers, seals, and flashing where indicated for weatherproof performance of the panel systems.

1. Connect roof panels to purlins with concealed clips in accordance with manufacturer instructions.

2. Wall panels shall be continuous from wall base to roof, unless detailed otherwise on the Architectural Drawings.

B. Install sill angle, trim and closures to provide a weather/draft tight seal between the sill angle and top of concrete and at wall and roof panel interfaces

C. Install in accordance with manufacturer's instructions.

D. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

E. Fasten cladding system to structural supports, aligned level and plumb.

F. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing, all side laps will be at least one full corrugation. Seal all panel side and end laps with manufacturer's recommended weather sealing compound to prevent the entry of capillary moisture.

G. Use concealed fasteners to the greatest extent possible. Exterior exposed fasteners shall be permitted only where indicated on approved shop drawings.

H. Install insulation as indicated on approved shop drawings. At unsupported areas, place wire mesh under vinyl for support between framing members.

I. Install sealant and gaskets to prevent weather penetration.

J. System: Free of rattles, noise due to thermal movement and wind whistles.

3.04 INSTALLATION ACCESSORIES

A. Seal wall and roof accessories watertight and weather tight with sealant, in accordance with requirements of Section 07 92 00 – JOINT SEALANTS.

3.05 INTERFACE WITH OTHER WORK

A. Coordinate work with door frames, overhead door, glazed openings in accordance with respective product manufacturer requirements and as specified under related specification sections. Ensure work of this Section permits proper interface and installation of products installed into metal building systems work.

3.06 TOLERANCES

A. Framing Members, maximum variation from plumb or level: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

B. Siding and Roofing, maximum offset: 1/8 inch (3 mm) from true position

3.07 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

B. Clean work under provisions of Section 01 74 13 – CLEANING UP.

3.08 PROTECTION

A. Protect finished work under provisions of Section 01 52 13 - TEMPORARY FACILITIES.

END OF SECTION

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SECTION 14 22 13

CRANE SYSTEMS
(ADD ALTERNATE 4)

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section of the specifications covers furnishing and installation of one single girder underhung electrically operated bridge crane included in ADD Alternate 4.

B. The bridge crane shall be of the specified span and capacity, complete with end trucks, bridge girder, bridge control panel, motors, inverter bridge drive to provide two-step infinitely variable speed, wiring, electrification, festooned eight-button push button station, radio control, and warning strobe.

1.02 RELATED WORK:

A. Section 13 42 00, PREFABRICATED ENGINEERED BUILDINGS

B. Section 09 91 00, PAINTING

C. Section 11 00 00, EQUIPMENT - GENERAL

D. Division 26, ELECTRICAL (power connections only)

1.03 REFERENCES

A. American National Standards Institute (ANSI)

1. B30.20-1967, Safety Code for Overhead and Gantry Cranes
2. C1, National Electric Code

B. American Welding Society (AWS) D14.1, Specifications for Welding Industrial and Mill Cranes

C. Crane Manufacturers' Association of America (CMAA):

1. CMAA Specification No. 61, Clearance from Obstruction
2. CMAA Specification No. 74 Specifications for Underhung Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

D. Occupational Safety and Health Administration (OSHA), 29 CFR 1910, Subpart 179, Overhead and Gantry Cranes

E. National Association of Electrical Manufacturers (NEMA)

F. National Electric Code (NEC)

G. New York OSHA

H. New York Building Code

1.04 QUALITY ASSURANCE:

A. Overhead cranes shall be designed, manufactured, assembled, and shop tested by a single manufacturer in strict accordance with CMAA standards.

B. Manufacturer shall be a reputable firm able to demonstrate a minimum of five years' experience in design, manufacture, and assembly of cranes.

C. Certify that the design and installation of the cranes comply with Seismic criteria in accordance with the New York Building Code.

D. The Contractor shall guarantee that the components furnished are compatible and that the completed crane system shall be satisfactory and operational in all locations.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of complete shop drawings shall be submitted to the Engineer for review prior to the fabrication or manufacturing of any equipment.

B. Three sets of complete operation and maintenance manuals shall be submitted upon installation.

C. Crane drawings and certification stamped by a registered New York Structural Engineer.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Acceptable Manufacturers:

1. Mass Crane and Hoist, 72 Progress Ave., Tyngsboro MA 800-909-2299
2. Ace Industries, Inc., 6295 McDonough Dr., Norcross, GA 30093, 800-733-2231
3. L.K. Goodwin, 890 Broad St., Providence, RI 800-343-2478
4. These Specifications are not designed to limit the competition or to limit the equipment to any specific bidder. The specifications listed are minimum and must be met or exceeded. Additional acceptable manufacturers able to meet the specified requirements and quality may be approved by the Engineer.

B. Contractor shall be responsible for notification to, and coordination with other trades. If the equipment provided differed from that specified herein, Contractor shall provide all relevant data and requirements (e.g., power, structural) required by other trades for installation and operation of the equipment at no additional cost to the Owner.

C. All equipment shall be new and of first-class commercial grade, of the latest approved design. Construction, workmanship, and material must be the best quality, free from defects which would render it unsuitable or ineffective for the purpose for which it is to be used. Any fault due to defective design, material or workmanship which may develop shall be made good by, and at the expense of, the Contractor.

D. All electrical equipment shall operate on 480 Volt, 3-phase power

E. Girders to be designed in accordance with CMAA Specification No. 74.

F. All equipment shall conform to provisions of the National Electric Code and the latest specifications of the Crane Manufacturers Association of America (CMAA).

G. Each hoist shall be equipped with an electro-mechanical load limiting device that shall prevent lifting more than 110% of the rated load.

H. All materials shall be shop painted in accordance with manufacturers' standards. All field painting shall be by the crane manufacturer in accordance with Section 09 91 00 Painting.

I. Paint: Monorails, Bridge Cranes and hoists shall be painted safety yellow with the rated load painted clearly in black paint.

2.02 5-TON UNDERHUNG CRANE (A-1)

A. Crane shall be classified as CMAA Class C.

B. The 5-ton underhung crane shall consist of a single underhung girder and a structural runway with a festoon system. The crane shall have a maximized lifting height as shown on the Drawings (minimum of 18’-9”.). Underhung girder and structural runway dimensions shall be based on the limits identified on the Contract Documents.

C. The Contractor shall support the bridge crane from the roof primary framing members at the column lines as indicated on the Drawings. The Contractor shall be responsible for supporting the crane from the framing members indicated in accordance with manufacturer requirements, in order to provide a complete and operable system, and shall determine the exact number of supports in accordance with the manufacturer’s requirements for the rated loading of the crane. Crane clearance over the mezzanine shall be maximized. <u>Contractor shall submit a stamped design certification letter for the crane supports, girder, runway and other crane components from a registered structural engineer</u>

in the State of New York, indicating that the crane is properly connected/supported to the roof framing members for the cranes' rated capacity.

D. Hoist to include 5-ton capacity R&M wire rope hoist, two speed (19/3.2 FPM) motor.

E. Trolley to be operated by a 65 FPM VFD motor.

F. Bridge to be operated by a 100 FPM VFD motor. Bridge controls to be push button, festooned across the bridge on a separate track.

G. Deflection of the rail shall be limited to a maximum of 1/450 (vertical) and 1/400 (horizontal) of the span.

H. All supporting details shall be fabricated of structural steel, plate or forgings only. No castings will be permitted. System shall be suspended using components supplied by the crane manufacturer or approved equal.

I. The rated load of the crane shall be the maximum load for which the crane is designed and built by the manufacturer. In determining the rated load, all handling devices such as buckets, magnets, grabs, etc., shall be included as part of the load to be handled.

2.03 5-TON UNDERHUNG CRANE ELECTRIFICATION:

A. Power shall be supplied by means of enclosed rigid type contact conductors mounted parallel to the track. Conductors shall comply with the provisions of Article 610, ANSI CI National Electric Code.

B. Capacity of contact conductors shall be sized to carry the required current to the hoist when operating with the rated load minimum, 50 amp mainline disconnect consisting of a combination circuit breaker (50,000 AIC) and non-reversing starter, starter without overloads (mainline contactor) in NEMA Type 4 enclosure shall be provided. Mainline disconnect shall be equipped with energy isolating devices designed to accept lockout devices.

C. Electrical enclosures to be NEMA 4 enclosures, unless otherwise indicated.

D. Provide electrical transformer, sized to system, to step down voltages for the required controls and accessories.

E. Collectors shall be of the wheel or shoe type and shall be designed to reduce to a minimum sparking between the wheel or show and the contact conductor. Conductors shall carry the seal of Underwriters' Laboratories.

F. Disconnect and power feeds shall be in accordance with Division 26, ELECTRICAL.

2.04 5-TON UNDERHUNG CRANE CONTROLS:

A. Crane controls to be designed such that operator will be safely away from lifting load. Emergency safety stops to be provided locally at the crane motor and via remote control.

B. Push button controls and cable assembly shall be suspended from an independent festoon track. The pushbutton station shall have a NEMA4 rating with the following features: bright yellow polypropylene enclosure for easy visibility, 8-button enclosure, momentary on/off, six each 2-speed buttons, double break silver-plated switch contacts, multi-grip cord grip accepts eight through 24 conductor round cable, strain relief cable and fittings, easy to read legend plates, replaceable neoprene boots, neoprene bushing, and warning tag.

C. Push button festooning shall carry control wiring from the independently suspended push button station to the control panel. Push button festooning shall be a rugged steel C track system with trolleys, NEMA12 junction box, flat cable, and all other components required to control the 2-step bridge control panel, the 2-speed hoist, and the 2-stop trolley.

D. Radio controls shall have safety features that include receiver self-diagnosing, transmitter self-diagnosing, transmitter low voltage detection and warning, transmitter and receiver MAIN deactivation when the transmitter is not in use, during transmitter low voltage, and when the system is in sleep mode. The encoder/decoder system shall utilize advanced microprocessor control. If the receiver MAIN relay is defective (fails to open or close during operation), the safety relays shall signal the system to shut-down immediately to avoid the possibility of any accidents occurring. Synthesized PLL receiving module shall accept signals from 30 available channels. Transmitter and receiver enclosures shall be fully waterproofed and also be impervious to dust, water, oil, grease, acid, alkaline, heat, and sunlight.

E. Remote controller unit shall operate via rechargeable battery. Equipment supplier to provide the following:

   1. Battery backups to cover power requirements for three full shifts of operation
   2. Battery charger unit and/or cords

F. Crane mounted controls shall be enclosed in NEMA 4 enclosures, pre-wired and tested prior to shipment, unless otherwise noted.

G. Provide electrical transformer, sized to system, to step down voltages for the required controls and accessories.

H. Disconnect and power feeds shall be in accordance with Division 26 Electrical and as shown on the Electrical Drawings.

2.05 CERTIFICATION:

A. Provide certification of all factory tests, including, but not limited to:
   a. Electric wire rope hoist testing
   b. Crane hook non-destructive testing
   c. Safety features such as limit switches and emergency stops
   d. Power supply and electrical components
   e. New York Structural Professional Engineer Certification

PART 3 - EXECUTION

3.01 INSTALLATION/TESTING:

A. Transportation, installation, start-up, and full scale load test to be included under this section.

B. Leveling and bracing per CMAA code.

C. At the conclusion of the installation, the Contractor shall demonstrate the ability of the equipment to handle the required capacity load smoothly and easily.

D. Equipment supplier to provide up to four hours of training on the operation and maintenance of the crane system at no additional cost to the Owner.

E. All cranes shall come with a minimum one year warranty beginning. The Contractor shall perform all necessary repairs and replace equipment if needed during the one year period at no additional cost to the Owner.

F. The general components of the system only are described above and shown on the drawings and not all components are specified. The Contractor shall provide all equipment, materials, and labor necessary for a complete, operable, and code compliant system in accordance with the manufacturer's recommendations. The Crane hoist/bridge/runway motor horsepower ratings shall be modified as needed at no additional cost to meet the above performance requirements.

G. All electrical work for this section shall be provided by a New York Licensed Electrician.

END OF SECTION

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SECTION 14 45 00

VEHICLE LIFTS

## PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specifications covers furnishing and installing vehicle and equipment lifts, as indicated on the plans and herein.

1.02 RELATED WORK:

A. Division 3, CONCRETE
B. Division 11, EQUIPMENT
C. Division 26, ELECTRICAL

1.03 REFERENCES:
A. Automotive Lift Institute (ALI) 2015 standards
B. Occupational Safety and Health Administration (OSHA) requirements
C. UL-201, Standard for safety of garage equipment

1.03 QUALITY ASSURANCE:

A. Vehicle and equipment lifts shall be designed, manufactured, assembled, and shop tested by a single manufacturer. All lifts supplied for the project shall be by a single manufacturer.
B. Manufacturer shall be a reputable firm able to demonstrate a minimum of five years' experience in design, manufacture, and assembly of vehicle and equipment lifts.
C. The Contractor shall guarantee that the components furnished are compatible and that the completed system shall be satisfactory and operational in all locations.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six (6) sets of complete shop drawings shall be submitted to the Engineer for review prior to the fabrication or manufacturing of any equipment.
B. Provide electrical, structural, and dimensional requirements prior to the fabrication and manufacturing of any equipment.
C. Three (3) sets of complete operation and maintenance manuals shall be submitted after the shop drawings have been reviewed.

PART 2 – PRODUCTS

2.01 EQUIPMENT:

A. GENERAL:

1. These specifications are not designed to limit the competition or to limit the equipment to any specific bidder. The specifications listed are minimum and must be met or exceeded.

2. Contractor shall be responsible for notification to, and coordination with, other trades. If the equipment provided differs from that specified herein, Contractor shall provide all relevant data and requirements (e.g., power, structural) required by other trades for installation and operation of the equipment at no additional cost to the Owner.

3. Concrete floor requirements – General Contractor to verify with supplier prior to installation of concrete floor.

B. FOUR POST MOBILE LIFT (B-1):

1. Manufacturers: Specifications listed below are based on Rotary Model Flex Max M419. Approved equals include Mohawk 18,000lbs mobile column lift model MP-800-18, or Stertil Koni 18,500lbs mobile column lift model ST 1085. Contractor shall coordinate utility requirements for approved equipment with subcontractors to ensure proper services and utilities are provided for approved equipment. Contractor is responsible for providing alternate services for approved equipment at no additional cost to the owner.

2. HEAVY DUTY 75,200 LB. CAPACITY SURFACE MOUNTED WHEEL ENGAGING MOBILE COLUMN LIFTS FLEX MAX M419 SERIES

a. Lift Characteristics:

1) The intent of this specification is to establish the minimum standards of quality and performance for portable mobile column lifts which will be used to lift a variety of vehicles including Trucks, Buses, Passenger Vehicles, Forklifts, and other general service vehicles. This specification shall describe a mobile column surface mounted, wheel engaging lifting system designed to elevate vehicles for the purpose of inspection and maintenance. One Lifting System shall consist of four electric-hydraulic mobile columns sustaining 75,200 lb. capacities (18,800 lbs) per mobile column). Mobile columns may be added, (not exceeding 8 columns), removed, or changed out. The mobile columns shall be battery operated with a DC charging system built into each column for easy recharge.

b. MACH FLEX 4 Series - 4 Mobile Columns: Capacity, 75,200 lbs; 18,800 lbs. per column.

c. Shipping Weight: 1485 lbs (674 kg).

d. Weight Per Column: 1400 lbs. (635 kg).

e. Lifting Fork Length: 14 inches (356 mm) forks accommodate rim sizes 9 inches (229 mm) minimum to 24-1/2 inches (622 mm) maximum.

f. Floor requirements 4-1/2 inches thick (minimum) 3000 psi concrete not to exceed a side to side floor slope of 1/8 inch = 1 foot 0 inches and not to exceed a 1/4 inch = 1 foot 0 inches floor slope fore and aft.

g. Motor: 3kw, 24 volt minimum.

h. Hydraulic Tank Capacity: 10.5 quarts (10 liters) mobile columns will require 11-1/2 quarts (11 liters) of fluid to fill tank, hoses, and cylinders. Bio-Fluid compatible.

i. Overall Height at Full Lower: 102 inches (2591 mm).
j. Overall Height at Full Rise: 144-3/8 inches (3677 mm).
k. Overall Width: 45-1/2 inches (1156 mm).
l. Overall Length: 48-9/16 inches (1234 mm).
m. Turning Radius: 45 inches (1143 mm).
n. Rise: 70 inches (1778 mm).

o. Lifting/Lowering Speed: 78 seconds to full rise - 54 seconds to fully lowered position.

p. Control Voltage: 24 volts DC. Rechargeable by 110 Volt Automatic Weather Tight Marine Charger.
q. Battery Charge Cycle: (New Battery) 20 cycles per charge at rated load of the lift. Lifting less than rated load will allow more cycles per charge.

r. Fabrication:

1) Column Assemblies:

1. Columns shall be constructed of formed channel fabrication from a single steel plate and shall not require welded seams to form the column structure.
2. Columns shall be further reinforced externally along their back face with structural steel angle for additional rigidity and extended service life. Rigid column design shall be protected from corrosion via sand blasted enamel painting of metal surfaces.
3. Each column shall be fabricated to a set of legs that will sit directly on the floor and provide a stable platform when lifting a load. When unloaded the mobile columns ride on a set of wheels to allow the units to be moved. When a vehicle is lifted, the wheels shall automatically retract and the lift shall sit down flat on its steel

base and no lifted weight shall remain on the casters. Legs have an extended fork configuration that allows for extensions to be added at any time. Such extensions will permit the addition of longer forks to lift dual wheel assemblies or optional assemblies for lifting vehicles further away form the column assembly.

4. Each of the lifting units shall contain a mechanical locking latch mechanism completely separate from the drive of lifting system. This lock shall be gravity actuated with a spring loaded assist to ensure engagement at any position. Spacing between locking positions shall be a maximum of 3 inches (76 mm) in accordance with ALCTV.
5. The column structures shall be easily moveable on three wheels consisting of two fixed heavy duty steel wheels and a dual rubber coated steering wheel mounted at the rear of the column. Columns shall come equipped with a hoisting hook for lifting by overhead crane and a fork lift pocket lifting points on each column for ease of relocation by standard fork lift.

2) Carriage Assemblies:

1. Each column assembly shall include a carriage assembly which consists of 4 Ultra High Molecular Weight (UHMW) roller bearings. These bearings shall be oil impregnated and shall not require any greasing or maintenance of any kind.
2. Each carriage assembly shall include a full enclosure for the lifting cylinder chrome rod. No part of the chrome lifting cylinder shall be exposed to impact at any time during the lifting stroke.
3. Forks shall provide a minimum of 12 inches of sufficient safety clearance between column and body of vehicle. Forks shall also be available in an optional extended configuration capable of supporting inboard tires on dual-wheeled axles.
4. Carriage assemblies shall come equipped with adjustable lifting forks to allow for adjustment of lifting forks for small tire applications to standard large tire applications without need for adapter sleeves. Forks shall include handles to facilitate the lateral adjustment of forks for narrower and wider tires. Adjustment shall be accomplished by release of a spring-loaded lock on the top of the fork. When adjustment of the forks is complete, locks shall automatically re-engage to secure forks from further movement.

3) Hydraulic System:

1. Each lifting unit shall be equipped with an electric hydraulic power unit, consisting of a DC motor, gear pump, reservoir, check valve, pressure relief valve, and two control valves. Entire power unit totally enclosed to protect from dirt and water.
2. The direct drive lifting cylinder shall be installed in such a manner as to push the carriage up, using no chains or cables. The extension of the cylinder shall occur inside of the carriage as to keep the

plunger of the cylinder protected from dirt, sand, or any possible mechanical damage.

3. Hydraulic check valve shall hold load at any position of the cylinder. Redundant mechanical safety lock shall be continuously engaged except while lift is being lowered.
4. Solid zinc plated steel pipes are used to circulate all hydraulic fluids in the system.
5. Pressure relief valve shall prevent overloading of the lifting unit.
6. Unit shall be equipped with two control valves that shall be used to maintain synchronous operation when a lifting system of more than one column is being commanded to raise or lower.
7. Hydraulic system is self-lubricating and shall require little to no maintenance or lubrication of the hydraulic cylinder.
8. A velocity fuse shall be installed directly to the end of the cylinder in order to keep hydraulic fluids from discharging if there is a fast leak somewhere after the cylinder, which could cause the load to unintentionally be lowered.

4) Control System: Remote Control Wireless Operation (No Cord)

1. Handheld wireless remote control capable of controlling a system of 2, 4, 6, or 8 columns. With a battery life is 16 hours of continuous operation on a full charge.
2. "Resume" button to recall previous system ID and column assignments
3. "Press Protect" mode enables after 5 seconds. Waking the system from this mode results in all the columns in the system beeping and flashing, to confirm to the user which columns are being controlled, with a second button press required to start motion and protect against inadvertent button presses.
4. Guided quick set-up process, with the remoted control indicating the order of column power on around the vehicle.
5. Class I division 2 group D rated remote control
6. Charging cradle, with 50% re-charge in a half-hour.
7. Battery can be changed by removing one screw
8. Ergonomic rubberized grip area
9. One-handed operation
10. Recessed motion buttons to guard against accidental press
11. All mobile control panels and remote control are waterproof NEMA Type 4.
12. Column control circuits and motor power supply circuits shall be 24 volts.
13. Circuit board programming is upgradeable. Upgrades in software or control programming shall be available by swapping a SD card or wireless connection. Board replacement for reprogramming by the user shall not be necessary.
14. All mobile columns shall have a manual lowering override due to loss of power to the unit.
15. "UP" and "Down" buttons on the columns shall have momentary

function "Hold To Run" type switches while depressed and operate from only one control panel at a time. The joystick operation on the remote control is also "Hold To Run".

16. "Emergency Stop Button" on each column or remote control will shut down all connected mobile columns.
17. All columns have automatic synchronization through the full stoke of the hydraulic cylinder with a maximum tolerance of 1 inch.
18. Control system will actively control hydraulic correction to maintain level synchronization, unless a column deviates more than 3.5 inches from any other column, at which point all motion halts and an error alert is generated.
19. Error codes and other diagnostic information is automatically provided when a fault is detected via alpha-numeric display, audible alarm and visual indicator.
20. Alpha-numeric display will show height of column fork, system id and weight being picked up by that column in hundreds of pounds.
21. System can display both SI and Metric units
22. Programmable height limit settings with no external limit switches.
23. Lift system shall come equipped with a lower to lock function.
24. Lift system shall come equipped with a slow lowering function.
25. Each column shall have its own 110 volt, two (5) amp, 2 -bank battery smart-charger. The battery charger shall have two independent 12 VDC output leads and incorporate automatic 3-stage charging to minimize charge time and maximize battery life. Total recovery time for a completely discharged system is less than 12 hours. All battery chargers in a system can be connected together into a single 110V receptacle.
26. The lift control interface (remote control) shall include visual representations showing the relationships between the lift columns and a vehicle, such as lift column icons positioned around a vehicle icon.
27. Lift shall come equipped with a three color battery charge indicator. The charger shall also indicate the status of the battery.
28. Lift will be equipped with a LockLight (tm) to show when the lift has been lowered to its locks. This light should be easily seen from more than 50 feet by a casual observer.
29. Added control of lift system at a column or at the remote control.
30. Single/Pair/All selector button on column interface to help user choose the type of lift system operation after pairing the group.

5) Accessories

a. Contractor shall provide four (4) portable maintenance jack stands. Jack stands shall be manufactured by Rotary model RS20YL or approved equal.

C. TWO POST SURFACE MOUNTED LIFT 18K (B-2)

1. Manufacturers: Specifications listed below are based on Mohawk TP-18 Two-Post Lift. Approved equals include Rotary SPO20 two-post lift or Stertil-Koni SK2.20 two-post lift. Contractor shall coordinate utility requirements for approved equipment with subcontractors to ensure proper services and utilities are provided for approved equipment. Contractor is responsible for providing alternate services for approved equipment at no additional cost to the owner.

2. MOHAWK TP-18 18,000 LB. CAPACITY TWO-POST LIFT

   a. Complete lift assembly shall consist of an electric over hydraulic lift unit, controls, and any accessories as specified herein.

   b. Lifting capacity will be 18,000 lbs. Minimum

   c. Lifting stroke will be 72" minimum. This dimension is measured from the floor to underneath the swing arm when the lift is at full height. Measurement to the top of the swing arm shall not be added to the vertical travel to arrive at lifting stroke.

   d. Lifting height will be 77" minimum. This measurement is measured from the floor to the top of the lifting pad when the lift is at full height and the lifting pad is at its lowest position.

   e. Lifting height will be 82" with 5" truck adapter, 84-1/2" with 7-1/2" truck adapter, and 87" with 10" truck adapters.

   f. Gravity activated locks in each column; working independently of each other shall start locking at a minimum of five (5) inches off the floor. The mechanical locks in each column will engage every three (3) inches thereafter to full lifting height.

   g. The lock body will be made of 1" thick, a-36 grade steel measuring 4"x6".

   h. Each individual locking device shall be capable of supporting the entire rated load of the lifting leg.

   i. The locking mechanism shall be mechanically operated and shall normally be engaging a locked position.

   j. The mechanical locks are released manually. The mechanical locks will re-engage automatically every time the lift is raised. The mechanical locks shall allow the operator to release the locks and lower the lift without continuing to hold a lock release. Air operated lock release is not acceptable due to reliance on compressed air supply.

   k. Lifting speed will be 80 seconds minimum from the floor to full height.

1. Lifting Column

   a. Each column will be constructed of 3/4-inch "r-34" forklift channel and be rigidly supported and joined together with 3/4-inch steel plate using 3 point fillet welds. Formed, tubular, or bent columns are not acceptable.

   b. Each column will be a minimum of 19" wide x 9" deep. These larger

heavy duty columns give better, safer support when lifting heavier, uneven loads. Smaller, lighter duty columns will not be accepted.

c. Each column will have a base plate made from 3/4” thick grade a-36 steel plates, minimum. The base plate will be 29-1/2” x 23-3/4”, minimum. This base plate is designed to have less than 50 psi of pressure on the concrete floor with a full load.

2. Carriage Assembly

a. Each column will have a carriage constructed of 3/4- inch steel plate joined to a 3/8-inch backing plate by 3 point fillet welds, minimum.

b. The carriage assembly will roll up and down smoothly in the forklift mast columns on four (4) 4 inch double sealed self-lubricating steel ball bearing rollers. Plastic or nylon type slide blocks and bushing type rollers are not acceptable.

c. The carriage assembly shall not require any monthly cleaning with solvents or any lubrication. All wear surfaces shall be completely sealed and self lubricating with no grease requirements.

d. The carriage will also include four (4) 4 inch double sealed self-lubricating steel ball bearing rollers acting as thrust bearings to eliminate the stress of unevenly distributed loads. Plastic or nylon type bearings or slide blocks are not acceptable.

e. The carriage will be lifted by means of a direct drive lifting system. The carriage will be connected directly to the top of the cylinder by (2) 1” diameter ASTM A-311 class b hardened steel rods. Cable, chain, and mechanical screw type designs are not acceptable.

f. Carriages will support the swing arms by sandwiching them in between 2 pieces of 3/4-inch steel plate that are joined together by 3 point fillet welds. The swing arms will be held in place by a 1-3/8 inch diameter steel pin with nylon lock nuts on each side. Swing arms that are not supported by a “top plate and bottom plate” on the carriage are not acceptable.

3. Lifting Arms

a. Lifting arms will be a constructed of two pieces of grade a-500-b structural tubing. This tubing must have a minimum tensile strength of 75,000 psi and minimum yield strength of 60,000 psi.

b. The first piece called “swing arm” will be made of 4” x 6” x 1/4” wall thickness. The second piece called “slider” will be made from 3” x 5” x 1/4” thick wall. Slider ends shall be cap welded closed on both ends for added strength.

c. Lifting arms will accommodate the smallest of compact cars through medium sized trucks weighing up to 18,000 lbs.

d. Closed reach of 35-5/8” and an open reach of 55”. All four lifting arms

will be equal in length to safely support front wheel drive vehicles as well as vehicles with dual rear wheels, lift gates, dump body and utility bodies. Asymmetrical arms or rotated columns are not acceptable.

e. Lifting arms will be equipped with arm restraints that operate automatically. Manually operated arm restraints are not acceptable.

f. Swing arm restraints will be made from 1” diameter heat treated Rockwell hardness 50/55 steel pins that drop down through the carriage and are forced downward by a tensioning spring. The tensioning spring forces the pin to wedge against the swing arm securing it in place. The swing arms automatically secure themselves when the lift is raised and release automatically when the lift is fully lowered.

g. Lifting pads will be made from 4-1/2” x 6” steel plate with steel corrugated surface for positive gripping on flat surfaces or lifting by unibody pinch welds. Rubber or plastic lifting pads are not acceptable due to wear and decrease co-efficient of friction as rubber pads get oily.

h. Lift pads must have a 4-1/2” x 6” lifting surface at all times including when truck adapters are in use. Smaller lifting surfaces such as flip-up pads are not acceptable.

i. Arm restraints will be of an infinite position design causing arms to be held in place at every point in their rotation. Geared teeth type arm restraints are not acceptable due to finite position restraint locations and chipped gears found on this design which when “chipped” cause arms to not hold position.

4. Lift Dimensions

a. Column height 8’7” maximum

b. Hydraulic line height set at fifteen (15) foot standard height; adjustable to accommodate any ceiling height. Lifts with overhead cable covers the required an electrical safety shut off switch are not acceptable.

c. Optional in floor hydraulic lines routed in the concrete slab using seamless stainless steel hydraulic lines. This feature leaves no overhead lines allowing for taller vehicles to be lifted the full 6’ lifting height and overhead cranes to move freely around the lift.

d. Maximum structural protrusion from the lift column shall be 13’ 6” measured from the floor to the top of the cylinder at full lifting height.

e. Width between columns will be ten (10) foot standard, minimum. Width can be adjustable to accommodate wider vehicles or narrowed for tight bays.

f. Width between lifting arms eight foot ten inches (8’9”) minimum; adjustable to accommodate wider vehicles.

g. Pad height 5” maximum at lowest position when the lift is all the way down.

h. Lifting height 77” at the top of the pad at full lifting height.

i. Lifting height with 5” truck adapters 82” at full lifting height.

j. Lifting height with 7-1/2” truck adapters 84-1/2” at full lifting height.

k. Lifting height with 10” truck adapters 87” at full lifting height.

5. Hydraulics

a. The lift shall incorporate a master / slave hydraulic which synchronizes elevations during both raising and lowering operations with the most adverse rated load placed on the lift. The lift shall come equipped with a fully automatic leveling control and manual over-ride as a backup. Chains or cable equalized lifts are not acceptable.

b. Internal hydraulic safeties on both cylinders shall detect main side to offside pressure differentials of less than 200 lbs. Should the pressure change or an imbalance occur for any reason, the lift will hydraulically lock on both sides.

c. Hydraulic cylinders will be made of 2-5/8” chrome rod. The oversized chrome rod will be packed in a 4” x 6’ barrel, minimum.

d. Full load working pressure will be a maximum of 2,100 psi. Higher pressure systems will not be accepted due to higher pressures causing seal leakage, premature power unit failure and cylinder wear.

e. Cylinder packing consists of the following parker brand seals:
Dynamic piston t - seals
2 back-up rings
2 static o-rings
Rod wiper
Rod t – seals

f. Lift will be equipped with external hydraulic safeties consisting of velocity fuses mounted on each cylinder which hydraulically lock in the event of a leak, plus a factory set pressure compensated flow control valve to limit descent speed.

g. Seamless stainless steel hydraulic tubing with a burst rating of 14,000 psi, minimum. Rubber, steel braided, or plastic hydraulic hoses are not acceptable.

h. All hydraulic fittings will be standard JIC or O-ring boss fittings. Self-flaring or compression fittings are not acceptable.

i. Hydraulic fluid will be DEXRON III, ATF.

6. Power Unit

a. Power unit can be mounted on either driver side or passenger side column and will consist of:
Electric motor

b. Hydraulic pump

c. Steel oil reservoir (plastic reservoirs not acceptable

d. Suction strainer

e. Hydraulic gear pump

f. All hydraulic valving manifold

g. Electric motor is American made 4 h.p. 208v / 230v 3 phase 60 hz minimum. The motor will have maximum full amp loads of 14.5 amps @ 230v.

h. Hydraulic pump is a pressure balanced gear pump with fixed displacement, external tooth, and all steel gears. The pump must be extremely tolerant of fluid contaminants and resistant to galling caused by low viscosity start-up. Hard coat processed internal pump surfaces for extended service life.

i. The controls shall be column mounted with the unit operated by a push button up and manual don lever.

7. Standard Equipment

a. Truck adapters, (4) 5” and (4) 7-1/2”, and (4) 10” adapters. Flip type and screw type pads are not acceptable due to longer set up time, higher arm pad heights or smaller lift pad contact surface.

b. Male and female electrical hubbell plugs, male plug prewired on lift with female plug in parts box.

c. (16) 3/4” x 6” wej-it anchor bolts

d. Touch-up paint, 1 can each of red & yellow.

e. Dexron iii atf for hydraulic pump and reservoir.

f. Shims to level the columns for proper installation.

g. Safety and operations manual.

h. ANSI/ALI booklet (ALI standard # ALOIM-2008).

i. ANSI/ALI lifting it right booklet (ALI standard # sm01-2).

j. ANSI/ALI lifting point guide booklet (ALI standard # ALI/LP-guide).

k. ANSI/ALI safety decals affixed to lift.

8. Warranty

a. Standard warranty on all structural components and power unit warranty is a full 5 years.

b. Hydraulic cylinders are covered by an extended cylinder warranty after the initial 5 year warranty has expired.

9. Accessories:

a. Utility station mounted to driver-side post. Utility station shall be provided with the following:

1) Two 110-Volt 3-prong outlets

2) Two air outlets
3) Two extension cord/air-line hooks

D. MOWER LIFT (B-3)

1. Unit shall be Handy Gruntavore 1800 #16867G or approved equal.

2. HANDY GRUNTAVORE 1800

a. Capacity: 1800 lbs.

b. Dimensions: 104” L x 60” W x 40” H

c. Work surface: 84”

d. Air source: 90-100psi

e. Construction: 11-gauge steel

f. Ramp length: 41”

PART 3 - EXECUTION

3.01. INSTALLATION/TESTING:

A. Contractor to provide complete fixed lift system in accordance with manufacturers requirements.

1. Installation of area of 197” x 472” is required with the control box set in a way that will enable the operator to see the whole lift and the surrounding area.

2. Pits for lifting channels shall be approximately sixteen and three quarters inches (16.75”) deep and thirty-five inches (35”) wide with angle iron placed in the angles of the pit along the perimeter, while bottom of each pit will be sloped at 1.0% maximum toward the floor drains in the pit.

3. Yellow/highly visible lines shall be laid out or drawn on the ground at a minimum distance of forty inches (40”) from the lift to prevent the presence of people in this area during lifting operation.

B. Contractor to coordinate with other trades to insure safe and proper operation of equipment, including:

1. Structural/concrete

2. Electrical

C. Contractor shall submit vehicle lift system to the Engineer for approval prior to installing garage concrete floor or providing electrical and compressed air service for the lift system, and shall ensure vehicle pit dimensions and utility requirements are properly coordinated prior to installation.

3.02 See electrical drawings for work being performed by the EC (power being provided to scissor lift control box) and the plumbing drawings (compressed air being provided to scissor lift control box). All other work needed to provide a complete and operable system shall be provide by the manufacturer

3.03 The Contractor shall submit vehicle lift system to the Engineer for approval prior to installing garage concrete floor and prior to providing electrical and compressed air service for the lift system, and shall ensure pit dimensions and utility requirements are properly coordinated prior to installation.

3.04 For all lifting systems the Contractor shall coordinate work with the electrical and plumbing drawings.

3.05 The lift shall be installed and tested in accordance with ALI requirements, and the lift manufacturer shall submit that this has been performed.

END OF SECTION

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SECTION 21 05 23
VALVES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.02 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

## PART 2 - PRODUCTS

2.01 VALVES

A. General: Valves shall have the following requirements:

1. Working pressure stamped or cast on bodies.
2. Stem packing serviceable without removing valve from line.
3. UL listed and FM approved and labeled for intended fire protection service. Sprinkler systems 175 WWP; stamped/cast on body.

B. Acceptable Manufacturers:

1. Gate Valves: Kennedy, Mueller, Nibco, Stockham, Victaulic.
2. Butterfly/Ball Valves, Indicating Type: Grinnell, Kennedy, Milwaukee, Stockham, Victaulic.
3. Check Valves: Grinnell, Kennedy, Nibco, Stockham, Victaulic.
4. Wall and Post Indicator Valves: Grinnell, Kennedy, Mueller, Nibco, Stockham, Victaulic.

2.02 GATE VALVES

A. 2-1/2 in. and Larger: IBBM, resilient wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 200 WWP; Stockham Fig. G-610.

B. 2-1/2 in. and Larger: IBBM, solid wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 300 WWP; Stockham Fig. F-670.

C. 2-1/2 in and Larger: IBBM, solid wedge disc, OS&Y, grooved ends, stems grooved for tamper switch, 250 WWP; Victaulic Series 771.

D. 2 in. and Smaller: Bronze body and bonnet, OS&Y, threaded ends, solid wedge, 175 WWP; Stockham Fig. B-133.

2.03 BUTTERFLY/BALL VALVE

A. 2-1/2 in. and Larger: Butterfly style, ductile iron body, lug type, aluminum bronze disc, stainless steel trim, EPDM seat, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, 200 WWP; Stockham #LD-72UF.

B. 2-1/2 in. and Larger: Butterfly style, ductile iron body, ductile iron disc coated with EPDM, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, grooved ends, 300 WWP; Victaulic Series 705W.

C. 2 in. and Smaller: Bronze body, threaded ends; indicating gear operator, provision for tamper switch; Milwaukee "Butterball".

2.04 CHECK VALVES

A. 2-1/2 in. and Larger: IBBM, swing type, rubber faced disc, bolted flange cap, flanged ends; Stockham #G-940.

B. 2-1/2 in. and Larger: Ductile iron body, aluminum bronze or ductile iron disc coated with EPDM, stainless steel shaft and spring, grooved ends, 250 WWP; Victaulic Series 717.

C. Wafer Type, 2-1/2 in. and Larger: Cast iron body, aluminum-bronze disc plates, stainless steel hinge pin and spring, stainless steel bolts and fasteners, Buna-N seat for water temperatures up to 150°F at 200 psi; Stockham #WG-950.

D. 2 in. and Smaller: Bronze body, swing type, rubber faced, threaded ends; Grinnell #3315.

2.05 BACKFLOW PREVENTERS

A. Backflow preventer provided by Plumbing Contractor. Coordinate hydraulically calculated size and requirements with the Plumbing Contractor.

2.06 PRESSURE REDUCING VALVES

A. Ductile iron body construction, nylon reinforced diaphragm, nylon reinforced brass and stainless steel pilot valve, integral strainer, pressure relief valve, adjustable pressure range.

B. Valve shall be UL listed and FM approved.

C. Design Equipment: Tyco Model PRV-1.

D. Acceptable Manufacturers: Cla-Val, Tyco, Viking.

2.07 MISCELLANEOUS

A. Trim and Test Valves: Ball, plug, angle or globe type; bronze body; threaded ends; UL listed.

1. Ball Valves: Bronze two-piece body, full port, threaded ends, chrome plated ball, blowout proof stem, reinforced TFE seats, 300 psi working pressure, UL listed, FM approved; Nibco Model KT-585-70-UL.

B. Hose Thread Drain Valves:

1. Ball Valve: Bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

C. Wall Post Indicator Valves: Straight or angled two-way adjustable; surface or recessed post with hardware, stem, operating wheel; IBBM, flanged end, 200 WWP, resilient wedge disc, square operating nut non-rising stem gate valve; Stockham #G-950 post and #G-605 valve.

2.08 UNDERGROUND VALVES AND ACCESSORIES

A. Combined water service provided by Plumbing Contractor. Coordinate hydraulically calculated size and requirements with the Plumbing Contractor.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. Provide all shutoff, check, drain and other type valves as required by Code as indicated and as required for proper system maintenance, isolation and safety.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide hose thread drain valves at all low points to enable complete drainage of all portions of the system.

D. For underground valves: Valve boxes shall be placed vertically over each valve, and the top of the box adjusted to proper grade, and the valve and box immediately backfilled with crushed stone carefully tamped into place. Valves shall be checked for proper operation before installation and, unless otherwise instructed are to be left in the open position.

E. Install valves per respective listing/approval.

F. Use 250 WWP, FM approved anti-water hammer check valves at discharge and bypass of fire pumps, otherwise use swing type.

G. Use ball valves for auxiliary drains and inspector test valves on dry pipe and pre-action systems.

END OF SECTION

SECTION 21 05 33
HEAT TRACING FOR FIRE PROTECTION PIPING

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 00 and Division 01 Specification Sections, apply to this Section.

B. Comply with all requirements of IEEE 515.1 "Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications".

1.02 WORK INCLUDED

A. Section includes plumbing trace heating for gutter and downspout deicing and flow maintenance in grease waste piping with the following trace heaters:

1. Self-regulating, parallel resistance.

1.03 SUBMITTAL

A. Product Data: For each type of product.

B. Operation and Maintenance Data: Specific for each system type.

## PART 2 - PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE TRACE HEATERS

A. Manufacturers: Chromalox, Raychem, Thermon.

B. Trace Heaters: Pair of parallel stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

C. Electrical Insulating Jacket: Flame-retardant polyolefin.

D. Capacities and Characteristics:

1. Freeze protection for fire protection systems:

a. Setpoint: Below 45 deg. F.

2. Electrical Characteristics for Single-Circuit Connection:

a. Volts: 120 or 277
b. Phase: Single
c. Hertz: 60.

3. Temperature of heating cable in direct contact with pipe shall not exceed 200 deg. F.

2.02 CONTROLS

A. Controls:

1. Ambient temperature sensing.
2. Minimum 24-hour battery carryover.
3. On-off-auto switch with indicating light.
4. Relays with contacts to indicate operational status, on or off.
5. NEMA 4X enclosure

2.03 ACCESSORIES

A. Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 210553 "Identification for Fire Protection Piping and Equipment."

C. Warning Tape: Continuously printed "Electric Traced"; vinyl, at least 3 mils (0.08 mm) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, and 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.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Examine surfaces and substrates to receive trace heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with trace heaters are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Freeze Protection for Fire Suppression Piping: Self-regulating, parallel-resistance trace heater; pipe-mounted temperature sensor control.

## 3.03 INSTALLATION

A. Install trace heaters across expansion, construction, and control joints according to manufacturer's written instructions; use conduit and slack cable to allow movement without damage to cable.

B. Trace Heater Installation for Freeze Protection for Fire Suppression Piping:

1. Install trace heaters after piping has been tested and before insulation is installed.
2. Install insulation over piping with trace heaters according to Section 210700 "Insulation."
3. Install warning tape on piping insulation where piping is equipped with trace heaters.

C. Set field-adjustable switches and circuit-breaker trip ranges.

## 3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform tests after trace heater installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test trace heaters for electrical continuity and insulation integrity before energizing.
3. Test trace heaters to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted trace heaters.

C. Trace heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

## 3.05 PROTECTION

A. Protect installed trace heaters, including nonheating leads, from damage during construction.

B. Remove and replace damaged trace heaters.

END OF SECTION

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SECTION 210554
PAINTING

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each coating.

1. Material analysis including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.
2. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods.

1.03 GENERAL

A. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green building Council LEED Credits EQ 4.1 and EQ 4.2.

1.04 QUALITY ASSURANCE

A. Materials:

1. All coating materials required by this section shall be provided by a single manufacturer, unless otherwise required or approved.
   a. Contractor: Firm with successful experience in painting work similar in scope of work of this project.
   b. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

## PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design Make:

1. Sherwin Williams Company.

B. Acceptable Makes:

1. Devoe & Raynolds Company
2. The Glidden Company
3. Benjamin Moore & Company
4. PPG Industries, Inc./Pittsburgh Paints

5. Pratt & Lambert, Inc.
6. Sherwin Williams Company

2.02 PRODUCTS

A. Colors:
1. As selected by Owner.

B. Lead Content:
1. Not more than 0.06 percent lead by weight (calculated as lead metal) in the total nonvolatile content of the paint or the equivalent measure of the lead in the dried film.

**PART 3 - EXECUTION**

3.01 INSPECTION

A. Verify that surfaces and conditions are ready for work in accordance with coating manufacturer's recommendations.

B. Prior to commencement of work, examine surfaces scheduled to be finished.

C. Report any unsatisfactory conditions in writing.

D. Do not apply coatings to unsatisfactory substrates.

E. Beginning painting work on an area will be deemed construed acceptance of surfaces in that area.

3.02 SCOPE

A. Fire protection components shall be painted by the Fire Protection Contractor.

B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. See schedule for color code.

C. Paint all hangers, rods and any other bare iron work in all exposed areas.

D. Paint all exterior metal or iron including all piping, supporting metals, etc., unless furnished with a factory finish. This shall include galvanized steel. Paint with galvanized primer and finish with epoxy of color selected by Architect. Exterior metal painting shall include all exposed plumbing piping, fittings, valves, etc.

E. Paint bare metal and touch up damaged finish on all fire protection equipment. Use heat resistant paint on all hot surfaces.

F. Paint all insulated and bare piping exposed to view in all areas.

G. Paint all uninsulated water pump casings and piping connections.

H. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contact must be touched up by Contractor responsible for same.

3.03 SURFACE PREPARATION

A. Apply coatings to surfaces that are clean and properly prepared in accordance with manufacturer's instructions and as herein specified. Remove dirt, dust, grease, oils and foreign matter. Prepare surface for proper texture necessary to optimum coating adhesion and intended finished appearance. Plan cleaning, preparation, and coating operations to avoid contamination of freshly coated surfaces.

B. Provide protection for non-removable items not called for coating. After application of coatings, install removed items. Use only skilled workmen for removal and replacement of such items.

C. Protect surfaces not called for coating. Clean, repair, or replace to the satisfaction of the Engineer/Owner's Representative any surfaces inadvertently spattered or coated.

D. Metal Work:

1. Remove all oil and grease with non-flammable solvent. Remove all rust with steel wool.
2. Patched Areas, Touch-up Areas. Clean and prepare all surfaces as required to provide a smooth, even substrate for proper application of finish.
3. Contractor must examine areas and conditions under which paint is to be applied and notify Engineer in writing of conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.04 APPLICATION

A. General:

1. Apply coatings in accordance with coating manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.
2. Apply successive coats after adequate cure of the preceding coat and within the recommended recoating time.
3. Complete coatings shall be free of defects such as runs, sags, variations in color, lap or brush marks, holidays, and skips.

B. Remove coatings not in compliance with this specification, reclean and re-prepare surfaces as specified, and apply coatings to comply with the contract documents.

3.05 SCHEDULE OF COATINGS FOR METAL SURFACES

A. Porous Surface:

1. The coating shall be Tough-Coat as manufactured by VAC Systems Industries, Foster 40-10, 40-20, or 40-23 as manufactured by Foster Products Corporation, or approved equal. Coating shall meet NFPA Standard 90A and 90B and contain an anti-microbial agent.

B. Non-Porous Surface:

1. The paint shall be Porta-Sept as manufactured by Porter Paints, Inc., Foster 40-26 as manufactured by Foster Products Corporation or approved equal. Paint shall contain an EPA registered anti-microbial, Intercept, which inhibits the growth of bacteria, mold, mildew and fungi.

3.06 COLOR CODING

A. Pipe coloring shall conform to the following schedule:

| **Piping System** | **Safety Color** |
|---|---|
| Air, Compressed | YELLOW |
| Fire Protection | RED |

END OF SECTION

SECTION 21 08 00
COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Commissioning is a systematic process of verifying that all building systems perform interactively according to the Owner's operational needs, the design documents, manufacturer's recommendations, good engineering and workmanship practices. This is achieved by beginning in the design phase and documenting the Owner's requirements and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation provided for the project is complete, accurate and represents the actual installed equipment.
4. Verify that the Owner's operating personnel are adequately trained.

C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

D. Abbreviations: The following are common abbreviations used in the Specifications. Definitions are found in Article 1.2.

A/E - Architects and Design Engineers

CxA - Commissioning Authority

CC - Controls Representative

CTR - Contractors Technical Representative

Cx - Commissioning

Cx Plan - Commissioning Plan Document

FPC - Fire Protection Representative

FT - Functional Performance Test

GC - General Contractor

MC - Mechanical Representative

PFI - Pre-Functional Inspection

PM - Project Manager (of the Owner)

PC - Plumbing Representative

TAB - Test and Balance Contractor

EC - Electrical Representative

1.02 STANDARD AND CORE COMPLIANCE

A. Commissioning will be accomplished to comply with, and in accordance with the requirements of the following:

1. 2020 Energy Conservation Construction Code of New York State, Section C408 System Commissioning.

1.03 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. Additional specific responsibilities, when required, of the fire protection representative, mechanical representative, TAB, controls representative, plumbing representative and those of the electrical representative are described in their particular contract specifications and documents. It is noted that the commissioning responsibilities of the Owner's Project Manager, Architect, HVAC Mechanical and Electrical Designers/Engineers and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services, and those responsibilities are listed here only for clarification of the commissioning process.

B. All Parties:

1. Follow the Commissioning Plan.

2. Attend the commissioning scoping meeting and additional meetings as necessary.

C. Commissioning Authority (CxA):

1. The CxA is not responsible for design concept, design criteria, compliance with codes, design or construction scheduling, cost estimating, or construction management. The CxA may assist with problem solving non-conformance or deficiencies, but ultimately that responsibility resides with the GC and A/E. The primary role of the CxA is to develop and coordinate the execution of the Commissioning Plan, observe and document system performance. Specifically, that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractor will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied by the CxA.

2. Construction and Acceptance Phase:

a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular

communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

b. Coordinate the commissioning work and, with the GC and CTRs, verify that commissioning activities are being scheduled into the master schedule.

c. Revise the Commissioning Plan as necessary.

d. Plan and conduct a commissioning scoping meeting.

e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

f. Before startup, gather and review the current control sequences and interlocks and work with installers and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

g. Review equipment submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.

h. Write and distribute prefunctional inspections. The CxA will provide the GC and installers a list of the required submittals. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

i. Develop prefunctional checklists for completion by Contractor.

j. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

k. Witness all or part of the fire protection piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify Owner's Project Manager of any deficiencies in results or procedures.

l. With necessary assistance and review from the Contractor and installers, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.

m. Confirm completion of prefunctional checklists by site observation and spot-checking.

n. Evaluate systems startup procedures by reviewing start-up reports and by selected site observation.

o. Analyze any functional performance trend logs and monitoring data to verify performance.

p. Maintain a master deficiency and resolution log and a separate testing record. Provide the GC, PM and installers with written progress reports and test results with recommended actions.

q. Review equipment warranties to verify that the Owner's responsibilities are clearly defined.

r. Oversee and approve the training of the Owner's operating personnel.

s. Compile and maintain a commissioning record and Systems Energy Manual.

t. Review the preparation of O&M manuals.

u. Provide a final commissioning report.

v. Return to the site at ten (10) months into the twelve (12) month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

w. Identify any warranty phase deficiencies and provide detailed documentation to the Contractor.

D. General Contractor (GC):

1. Construction and Acceptance Phase:

a. Include the cost of supporting commissioning in the contract price.

b. Attend a commissioning scoping meeting and other commissioning team meetings.

c. Furnish a copy of all construction documents, addenda, change orders and submittals and shop drawings related to commissioned equipment to the CxA. The CxA will forward a request to the GC for copies of the submittals that the CxA is required to review concurrently with the Engineer as required by the LEED guidelines. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

d. Provide the requisite readiness notification to the CxA for equipment prefunctional inspections and functional testing utilizing forms provided by the CxA.

e. Participate in pre-functional inspections, startup and functional testing of all equipment, as directed by the CxA.

f. Review the functional performance test procedures submitted by the CxA, prior to testing, and provide comments.

g. Review commissioning progress and deficiency reports.

h. Coordinate the resolution of deficiencies identified by the CxA.

i. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan utilizing forms provided by the CxA.

j. Coordinate and perform the training of Owner personnel. Notify the CxA when training will be taking place.

k. Ensure that all installers execute their commissioning responsibilities according to the Contract Documents and schedule.

l. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

m. Ensure that installers correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

E. Installers (CTRs):

1. Construction and Acceptance Phase:

a. Attend all commissioning scoping meetings and other commissioning team meetings.

b. Provide the requisite readiness notification to the GC for equipment prefunctional inspections and functional testing.

c. Complete prefunctional checklists developed by the CxA.

d. Review the functional performance test procedures submitted by the CxA, prior to testing.

e. Review commissioning progress and deficiency reports.

f. Coordinate the resolution of deficiencies identified by the CxA.

g. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan.

h. Coordinate and perform the training of Owner personnel.

i. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

j. Ensure deficiencies are corrected and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

F. Equipment Suppliers:

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment commissioning with CTRs as per the Contract Documents.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.
4. Provide the information requested by the CxA regarding equipment sequences of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.

1.04 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

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 fire protection 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. Certificate of readiness certifying that fire protection systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.05 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

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 fire protection 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. Certificate of readiness certifying that fire protection systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.06 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project. The Owner and the CxA reserves the right to amend this list at anytime during the construction and acceptance process.

B. Fire Protection:
1. Dry Pipe system
2. Wet sprinkler system

**PART 2 - PRODUCTS**

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested.

B. Special equipment, tools, instruments, (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CxA.

C. Datalogging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

**PART 3 - EXECUTION**

3.01 MEETINGS

A. Scoping Meeting: The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Commissioning Plan to its final version, which will also be distributed to all parties.

B. Prefunctional Inspection (PFI) Meeting: The CxA will schedule, plan and conduct a PFI meeting with the entire commissioning team in attendance to kickoff the PFI phase.

C. Functional Performance Testing Meeting: The CxA will schedule, plan and conduct a functional performance test meeting with the entire commissioning team in attendance to kickoff the FT phase. The Controls Representative (CC) will play a critical role in the Functional Performance Testing. The CC's Project Manager will be required to attend this meeting.

D. Miscellaneous Meetings: Progress meetings will be scheduled and conducted by the CxA, as necessary. Other meetings will be planned and conducted by the CxA as the construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular CTRs. The CxA will plan these meetings and will minimize unnecessary time being spent by CTRs.

3.02 REPORTING

A. The CxA will provide regular reports to the Owner, PM, GC and A/E depending on the management structure, with increasing frequency as construction and commissioning progresses.

B. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised for commissioning progress, and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report by the CxA will be provided to the Owner. The report will include:

1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the CxA regarding the adequacy of the equipment, documentation, and training as it relates to the Contract Documents in the following areas:

   a. Equipment meeting the equipment specifications.

   b. Equipment installation.

   c. Functional performance and efficiency.

   d. Equipment documentation.

   e. Operator training.

2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment and operations, future actions, recommended commissioning process changes, etc. shall also be listed.

3. Also included in the Commissioning Record shall be the issues log, commissioning plan, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests and trend log analysis.

E. The CxA will compile a Systems Manual that consists of the following:

1. Space and use descriptions.
2. Single line drawings and schematics for major systems (to be provided by the Design Engineer).
3. Control drawings and sequences of control (to be provided by the Controls Contractor).
4. Schedules.
5. Instructions for operation of each piece of equipment for emergencies and shutdown.
6. Recommendation for recommissioning the facility.

3.03 SUBMITTALS

A. The CxA will provide the Contractor with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At a minimum the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of Owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA. All documentation requested by the CxA will be included by the CTRs in their O&M manual contributions.

B. The CxA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CxA will notify the Owner, PM, GC or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission. The CxA does not have approval responsibility, but is required to review the submittals concurrently with the Engineer as required by LEED guidelines.

C. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them.

## 3.04 SYSTEM START-UP AND TESTING

A. General Requirement:

1. All systems and system components shall be tested by the CTRs and in the presence of the Owner and Design Consultants if desired by the Owner and Design Consultants to demonstrate compliance with specified requirements. To minimize the time of commissioning, contracting, and Design Consultant team members, testing shall be done in seasonal single blocks of time insofar as possible.
2. The Contractor shall notify the CxA fourteen (14) days prior to scheduled functional performance tests, of the scheduled completion date of the installation verification and prefunctional inspections.
3. All testing shall be conducted under specified design operating conditions as approved by the CxA and Design Consultants.
4. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on a hierarchical basis. Each piece of equipment shall be tested for proper operation, and functionality of safety devices, followed by each system's subsystem, followed by the entire system, followed by any interlocks to other major systems.
5. All special testing materials and equipment shall be provided by the CTR. This includes, but is not limited to, proprietary equipment, hand-held control parameter/setpoint adjustment tools, water flow balancing readout and adjustment tools.
6. One (1) copy of all factory test reports and records as well as all start-up documentation shall be provided to the CxA.

B. Test Procedure Development and Test Documentation:

1. At least fourteen (14) days prior to startup of the fire protection system, the CTR shall inform the CxA, the Owner's Representative and Design Consultants of the intention to start up the system.

C. Installation Verification Requirements:

1. All systems and system components shall be checked and verified by the CTR that they have been installed according to the drawings, specifications, and manufacturer's written instructions, and that all connections have been made correctly. Discrepancies shall be corrected and resolved to the satisfaction of the Engineer and CxA prior to proceeding any further with prefunctional inspections.
2. Each system of interlocked system components shall be observed and verified by the CTR that it is ready to function as specified.

3. Verification of complete and proper installation shall be completed prior to the CxA authorizing functional performance testing.
4. The installation verification shall be documented by the CTR in a written format for each system/piece of equipment as designated by the CxA. Each certificate of readiness shall be dated and initialed by the Contractor and clearly stating any items that are deficient or have not been completed. The protocols for this will be further clarified in the Commissioning Plan.
5. Certify that fire protection systems, subsystems and equipment have been installed and started and are operating according to the Contract Documents.
6. Inspect and verify the position of each device and interlock identified on checklists.
7. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
8. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

D. Prefunctional Inspection Requirements:
1. The CxA will provide the inspection forms for each system and equipment.
2. Verification of completion of the prefunctional checklists is the responsibility of the CxA.
3. Prior to the CxA performing the prefunctional inspection, the CTRs shall check the equipment for proper installation, adjustments, and shall calibrate the equipment to verify that it is ready to perform as specified.
4. Verification of complete and proper installation shall be completed prior to performing functional performance tests.

E. Functional Performance Testing Requirements:
1. A functional performance test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of the CxA based on the written test procedure developed by the CxA to demonstrate conformance to the requirements of the Contract Documents.
2. Each functional performance test shall be performed, witnessed and signed off by the CxA. The CxA and the CTRs will perform the functional testing together. Any exceptions to this will be made clear to the Owner as to the reason and justification.
3. The functional performance testing shall be conducted in accordance with prior approved procedures and documented as required.
4. The Contractor shall notify the contracting team, the CxA, and Design Consultants, at least two weeks prior to the date of schedule functional performance tests. The schedule of functional performance tests shall be based on the construction completion schedule.

## 3.05 FUNCTIONAL TESTING SUPPORT REQUIREMENTS

A. General Requirements:

1. This section provides brief descriptions of the testing and support the Contractor and installers will be required to provide to perform the functional testing of the equipment for the project.

B. Fire Protection Systems:

1. The installer(s) will be required to demonstrate all safeties, local device operation, any local controls and any integrated 3rd party Building Management System controls INCLUDING ALL RELATED DEVICES AND SEQUENCE OF OPERATIONS.
2. The installer(s) will be required to manually operate all hand valves and automatic valves.

C. Pumping Systems:

1. The installer(s) will be required to demonstrate in writing that the pumps are balanced to achieve the specified design flows, including motor performance data as specified in the specifications. The Controls Contractor will be required to demonstrate that the pumps can start, stop, modulate speed (if required) and the lead/lag sequence performs as per the sequence of operations. In addition, a representative will be required to manually operate all hand valves.

D. Pipe system cleaning, flushing, hydrostatic tests and chemical treatment requirements are specified in fire protection piping sections. Fire Protection Contractor shall prepare a pipe system cleaning, flushing and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested and chemically treated.

## 3.06 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation - The CxA shall witness and document the results of all functional performance tests using the specific forms developed by the CxA for that purpose.

B. Non-Conformance:

1. The CxA will record the results of the PFIs and functional tests utilizing the appropriate documentation. All deficiencies or non-conformance issues shall be noted and reported to the Owner, PM, GC and CTRs.
2. Reports of the deficiencies identified will be provided to the project team by the CxA. Individual forms identifying the deficiencies for each trade will also be provided. These forms are utilized for the contractor to inform the CxA of the action taken to address the deficiency items and these forms must be returned in a timely manner to the CxA.
3. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases, the deficiency and resolution will be documented by the CxA.
4. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or compromising acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
5. Cost of Retesting:
   a. The cost for the Installer to repeat a prefunctional inspection or functional test, if they are responsible for the deficiency, shall be theirs.
   b. The time for the CxA to direct any retesting required because a specific prefunctional inspection of start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the appropriate CTR.
6. The Contractor shall respond in writing to the CxA at least as often as commissioning meetings are scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

C. Failure Due to Manufacturer Defect or Improper Installation - If 10%, or three (3), whichever is greater, of identical pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract Documents (either mechanically or substantively) due to manufacturing defect or improper installation, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CxA, PM, A/E or Owner. In such case, the Contractor shall provide the Owner with the following:

1. Within one (1) week of notification from the A/E (via the CxA), the installer or Manufacturer's Representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CxA or PM within two (2) weeks of the original notice.

2. Within two (2) weeks of the original notification, the installer or manufacturer shall provide a signed and dated written explanation of the problem, cause of failures, etc., and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The CxA, G/C and PM will determine whether a replacement of all identical units or a repair is acceptable.
4. Two (2) examples of the proposed solution will be installed by the Contractor and the CxA will be allowed to test the installations for up to one (1) week, upon which the CxA or PM will decide whether to accept the solution.
5. Upon acceptance, the installer and/or manufacturer shall replace or repair all identical items, at their expense, and extend warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one (1) week from when parts can be obtained.

D. Approval: The CxA documents each satisfactorily demonstrated functional test.

## 3.07 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:

1. The specific content and format requirements for the standard O&M manuals are detailed in the contract documents. Special requirements for the controls representative and TAB are detailed in the contract documents.
2. Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the specifications. The CxA will communicate deficiencies in the manuals to the CTRs, PM, FPC, GC, A/E or Owner as requested. Upon successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the PM, FPC, GC, A/E and Owner. The CxA also reviews each commissioned equipment's warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E contract.

## 3.08 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and for ultimately ensuring that training is completed. The GC shall inform the CxA when training will be scheduled.

B. The CxA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel for commissioned equipment.

C. The CxA shall interview the facility manager and lead engineer to determine the special needs and areas where training would be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned equipment.

D. In addition to these general requirements, the specific training requirements of Owner's personnel by CTRs, as detailed in the specifications, shall be provided.

E. Each CTR and vendor responsible for training will submit a written training plan to the CxA, for review and approval prior to training. The plan will cover the following elements:

1. Equipment (included in training).
2. Intended audience.
3. Location of training.
4. Objectives.
5. Subjects covered (description, duration of discussion, special methods, etc.).
6. Duration of training on each subject.
7. Instructor for each subject and qualifications.
8. Methods (classroom lecture, video, site walk thru, actual demonstrations, etc.).

F. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training.

3.09 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, and, who receives and approves them and the location of the specification to create them. In summary the written products are:

| | **Product** | **Developed By** |
|---|---|---|
| 1. | Final Commissioning Plan | CxA |
| 2. | Commissioning Schedules | CxA, GC and CTRs |
| 3. | Equipment Documentation Submittals | CTRs |
| 4. | Sequence Clarifications | A/E and CTRs as needed |

| | Product | Developed By |
|---|---|---|
| 5. | Pre-Functional Inspection Forms | CxA |
| 6. | Pre-Functional Inspections | CxA |
| 7. | Startup and Initial Checkout Plans | CTRs |
| 8. | Commissioning Progress Record | CxA |
| 9. | Issue and Resolution Log | CxA |
| 10. | Functional Test Procedures | CxA |
| 11. | O&M Manuals | CTRs |
| 12. | Commissioning Record | CxA |
| 13. | Overall Training Plans | GC and CTRs |
| 14. | Specific Training Syllabus | CxA |
| 15. | Final Commissioning Report | CxA |

END OF SECTION

SECTION 21 10 10
PIPING SYSTEMS AND ACCESSORIES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.02 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded Fittings: Class 125, cast or malleable iron, black or galvanized, as called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

a. Couplings: Ductile iron, ASTM A395 and ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish complying with ASTM A153 where called for.

b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.

c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.

d. Fittings: Elbows, tees, laterals, reducers, adapters as required shall be ductile iron conforming to ASTM A395 and A536, forged steel conforming to ASTM A234, or fabricated from carbon steel pipe conforming to ASTM A53. Fittings shall have grooves designed to accept grooved end couplings of the same manufacturer.

e. Victaulic, rigid system, Style 005 couplings cast with offsetting angle pattern bolt pads to provide system rigidity and support in accordance with ANSI B31.1 and B 31.9. UL listed and FM approved; 300 psi wwp; use a gasket and coupling system similar to Victaulic Flush-Seal for all dry type systems; follow all terms of listings/approvals.

f. Acceptable Manufacturers: Grinnell, Gruvlok by Anvil, Victaulic or approved equal.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

| ELBOW SIZE | SUPPORT SIZE | BASE PLATE |
|---|---|---|
| Up to 3 in. | 1-1/4 in. | 6 in. x 6 in. x 1/4 in. |
| 4 in. to 6 in. | 2-1/2 in. | 8 in. x 8 in. x 1/4 in. |

| ELBOW SIZE | SUPPORT SIZE | BASE PLATE |
|---|---|---|
| 8 in. and larger | 6 in. | 14 in. x 14 in. x 5/16 in. |

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.03 THINWALL STEEL PIPE

A. Pipe: ASTM A53, or A135, with Schedule 10 wall thickness for 2-1/2 in. through 5 in.; 0.134 in. for 6 in. and 0.188 in. for 8 in. and 10 in.; black or galvanized finish as called for; roll grooved ends.

B. Fittings: Same construction as noted for steel pipe, ends roll grooved for grooved mechanical connections.

2.04 COPPER TUBE AND FITTINGS

A. Pipe: ASTM B88; Type L, hard temper. Plans show copper tube sizes.

B. Tees, Elbows, and Reducers: Wrought copper, ASME B16.22 or cast bronze, ASME B16.18; solder end connections.

C. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.

E. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.05 SPECIAL FITTINGS

A. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.

B. Copper to Steel Piping:

1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.
2. Dielectric pipe fittings.

C. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

2.06 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory fabricated, companion flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Victaulic, Watts or approved equal.

2.07 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.
2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
3. Adjustable steel clevis type for piping 4 in. and larger.
4. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.

C. Spacing Schedule (Maximum Distance between Hangers (ft.-in.):

| **NOMINAL PIPE SIZE (IN.)** | **3/4** | **1** | **1-1/4** | **1-1/2** | **2** | **2-1/2** | **3** | **3-1/2** | **4** | **5** | **6** | **8** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Steel Pipe except Threaded Lightwall | N/A | 12-0 | 12-0 | 15-0 | 15-0 | 15-0 | 15-0 | 15-0 | 15-0 | 15-0 | 15-0 | 15-0 |
| Copper Tube | 8-0 | 8-0 | 10-0 | 10-0 | 12-0 | 12-0 | 12-0 | 12-0 | 15-0 | 15-0 | 15-0 | 15-0 |
| Rod Size (in.) | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 1/2 | 1/2 | 1/2 |

D. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller, complying with NFPA 13.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements, complying with NFPA 13.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal, complying with NFPA 13.

F. Supports:

1. For all piping larger than 2 in., provide intermediate structural steel members for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For weights under 1,000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

G. Hangers for fire protection piping as specified and in accordance with NFPA 13 and NFPA 14. Hangers and building attachments shall be UL listed and FM approved for fire protection service. Adjustable swivel ring type hangers are permitted for 3 in. and smaller piping.

## 2.08 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas.

B. All bushings and nipples required for instruments and gauges shall be brass.

## 2.09 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two (2) pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.10 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.11 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform to the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.12 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A" - Piping Materials at end of this Section for Fire Protection piping.

B. See Exhibit "B" - Testing at end of this Section for Fire Protection piping.

**PART 3 - EXECUTION**

3.01 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in size shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required, to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting systems. Conceal piping unless otherwise called for.

B. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing.

C. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation.

Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.02 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.03 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers on diesel engine exhaust piping where insulation/supports must pass between pipe and hanger. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor.

3.04 PIPE CONNECTIONS

A. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

B. Grooved Mechanical Joints: Pipes joined with grooved fittings shall be joined by a listed combination of fittings, couplings, gaskets and grooves of a single manufacturer. Lubricate and install gasket and couplings. Follow manufacturer's recommendations. Grooved ends shall be clean and free of indentations, projections and roll marks in the area from pipe end to groove.

C. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.

D. Dielectric Pipe Fittings: Protect fittings from excessive heat.

3.05 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by qualified welder. Use certified welder where specifically required by code or insurance company. If indicated and permitted for fire protection systems, all provisions for welded pipe shall additionally be in accordance with NFPA Standard 13. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.06 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.07 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior locations: Firmly pack with fiberglass and caulk.
2. Exterior walls above grade: Use sealing element.
3. Exterior walls below grade and above floors: Use sealing element.
4. Cored holes: Use sealing element.
5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
6. Waterproofed walls/floors: Use waterproof sealing element, device or compound.

3.08 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.09 TESTS

A. Fire suppression systems shall be hydrostatically tested at 200 psi for two (2) hours in accordance with NFPA 13.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative and shall be justified by hydraulic calculations. Where discrepancy in size occurs, the larger size shall be provided.

## EXHIBIT "A" - PIPING MATERIALS
**(Notes at end of Exhibit "A")**

| SERVICE | PIPE MATERIALS | FITTINGS | CONNECTIONS |
|---|---|---|---|
| Fire service | SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020 | | |
| Sprinkler (wet) | Schedule 40, black steel, 2 in. and smaller | Cast or malleable iron | Threaded |
| | "Thinwall" black steel, 2-1/2 in. and larger | Ductile iron | Roll grooved mechanical type couplings |
| | Schedule 40, black steel 2-1/2 in. and larger | Ductile iron | Roll grooved mechanical type couplings |
| Sprinkler dry | Schedule 40, galvanized steel, 2 in. and smaller | Galvanized cast or malleable iron | Threaded |
| | Schedule 40, galvanized steel, 2-1/2 in. and larger | Galvanized ductile iron | Roll grooved mechanical type couplings |
| Compressed air piping | Schedule 40, galvanized steel | Galvanized malleable iron | Threaded |

NOTES FOR EXHIBIT A:

NOTE 1: Provide schedule 40 galvanized steel pipe and fittings for all aboveground exterior locations passing through exterior walls such as downstream of inspector's test and auxiliary drain valves, between fire department connection and associated check valve, and where called for.

NOTE 2: Provide Class 250 fittings for threaded systems operating at working pressures above 175 psi.

NOTE 3: Dry piping systems shall be pitched as described in NFPA 13 to facilitate the removal of moisture from the system to minimize internal corrosion. Provide auxiliary drains as required to assure entire system is drainable.

## EXHIBIT "B" - TESTING

| SERVICE | TEST REQUIREMENTS |
| --- | --- |
| Sprinklers | Test hydrostatically at 200 psi for two (2) hours in accordance with NFPA 13. |

END OF SECTION

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SECTION 21 13 00
FIRE SUPPRESSION SPRINKLER SYSTEMS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 QUALITY ASSURANCE

A. Comply with the 2020 Fire Code of New York State referenced edition of the following National Fire Protection Association (NFPA) Standards:

1. NFPA 13: Standard for the Installation of Sprinkler Systems.
2. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
3. NFPA 72: National Fire Alarm Code.
4. NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations.
5. NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants.

B. Follow all requirements, recommendations and appendices to comply with the latest edition of the following publications, codes, standards, and listings/approvals:

1. Factory Mutual Engineering Corporation (FM) Approval Guide.
2. Underwriters Laboratories, Inc. (UL) Fire Protection Equipment Directory.
3. 2020 Fire Code of New York State.
4. OSHA Rules and Regulations.
5. Requirements of Insurance Underwriter and other Authorities Having Jurisdiction.

C. Equipment, devices, hangers and components shall be UL listed or FM approved and labeled for the intended fire protection service.

D. The fire protection work shall be performed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems.

E. Preparation of working plans, calculations and site observation of systems shall be completed by a NICET Level III technician under the direction of a qualified New York State Registered Professional Engineer.

1.03 SYSTEM DESCRIPTION

A. The fire protection system shall be a wet pipe and dry pipe automatic sprinkler system arranged to properly protect all spaces.

B. Water is supplied from a 12 in. municipal water main located in the town of Greenburgh, NY, through an 8" in. underground water main to the system's main riser. Water supply data at the municipal main indicates the following:

1. 110+ psi static.
2. Residual 54 psi residual with 2270 gpm flowing.

C. The residual hydrant is located at the Greenburgh property north of the site (higher elevation) with the flow hydrant located at the Greenburgh property north of the site (higher elevation). The flow test information above is submitted for information only. This contractor shall arrange for a new flow test on the municipal main prior to performing hydraulic calculations. The more restrictive of these two tests shall be used as the basis of design.

D. Fire department connection(s) shall be provided to allow the servicing fire department to augment the system's normal automatic water supply.

E. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any Authority Having Jurisdiction.

F. Use of room design method will not be permitted. Calculations shall be based upon the specific hazard for the areas being protected. The following minimum requirements shall be provided as actually installed in the protected spaces.

G. Maximum coverage for any sprinkler head shall not exceed NFPA requirements and the listing for the sprinklers provided.

H. A minimum 10% safety factor shall be provided between the available municipal water supply curve and the total system demand point. The total system demand point shall be at the municipal water main and include the calculated sprinkler and interior hose stream demands plus the exterior hose stream demand at the residual pressure required for proper system operation.

I. The maximum flow velocity shall not exceed 20 ft. per second in the piping system and 15 ft. per second in mains with paddle type waterflow indicators.

J. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Waterflow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.

K. Provide 3/16 in. x 1 in. cadmium plated carbon steel chains and master keyed all brass case hardened padlocks to lock water supply valves in the proper position.

1.04 SUBMITTALS

A. Product Data:

1. Submit manufacturer's catalog cut, specifications and installation instructions for each item or component of fire protection system. Clearly indicate pertinent information such as, but not limited to:

a. Manufacturer's model number.

b. Materials, size, finish and type of connection.

c. Pressure ratings of components.

d. FM approval/UL listing.

B. Certification: Submit Contractor's NICET certification and number.

C. Samples:

1. If requested, submit sample of sprinklers.

D. Drawings and Calculations:

1. All drawings and calculations shall be signed and sealed by a New York State Registered Professional Engineer.

2. Submit complete NFPA 13 drawings and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Owner's Representative, Insurance Underwriter, and other Authorities Having Jurisdiction.

3. Submit hydraulic calculations for each design density/remote area with items in NFPA 13 incorporated including sketches to indicate flow quantities, sprinklers operating and direction of flow for pipes in looped and gridded systems.

4. Drawing shall be fabrication drawings provided to indicate actual sprinkler, standpipe and equipment layouts. Drawings shall be 1/4" = 1'-0" scale on reproducible sheets of uniform size. Drawings shall show all data required by NFPA 13.

5. Submit drawings in one (1) complete package.

E. Record Drawings and Documents:

1. Submit Record Drawings, hydraulic calculations, test reports, and NFPA Above and Below Ground Material and Test Certificates to the Owner's Representative, Insurance Underwriter and other Authorities Having Jurisdiction.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Mixing of manufacturers or models of the same or similar component will not be acceptable.

2.02 FIRE DEPARTMENT CONNECTION

A. Cast brass; straight or angle body as required; two-way lug swivel inlets with individual drop clappers; cast brass; raised letter escutcheon labeled "AUTOSPKR"; matching brass plugs and chains.

1. 2-1/2 in. x 2-1/2 in. x 4 in.
2. 2-1/2 in. hose threads shall match those in use by the local Fire Department.
3. Polished brass escutcheon, inlets, plugs, and chains.
4. Design Equipment:
   a. Horizontal Flush Wall Type: Potter-Roemer 5020 Series.
   b. Projecting Wall Type: Potter-Roemer Fig. No. 5721.

B. Storz quick connect type with 30-degree elbow, cap, chain and escutcheon labeled "AUTOSPKR".

1. 4 in. Storz x 4 in. NPT.
2. Polished brass escutcheon, inlets, plugs and chains.
3. Design Equipment: Potter-Roemer Fig. No. 5795-01 connection with Fig. No. 5799-01 cap and chain.

C. Acceptable Manufacturers: Badger-Powhatan, Croker, Elkhart, Potter-Roemer or approved equal.

2.03 PRESSURE GAUGES

A. Water Pressure Gauge:

1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.
2. 0 to 300 psi range, in 5 psi increments with accuracy to meet ANSI B40.1.

B. Air Pressure Gauge:

1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.
2. 0 to 80 psi range, in 1 psi increments with accuracy to meet ANSI B40.1.

2.04 SPRINKLER EQUIPMENT

A. Alarm Check Valve: Vertical style with grooved ends, cast iron body, replaceable clapper facing, right or left hand alarm trim for variable pressure operation.

1. Trim:
   a. Main drain and valve.
   b. Gauges with gauge cocks.
   c. Galvanized pipe and trim fittings.

d. Retard chamber and pressure switch.

e. Water motor gong.

2. Design Equipment: Reliable Model E (175 psi).

3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

B. Riser Check Valve: Vertical style, grooved end, cast iron body and stainless steel clapper with replaceable facing.

1. Trim:

a. Main drain and valve.

b. Gauges with gauge cocks.

c. Galvanized pipe and trim fittings.

2. Design Equipment: Reliable Model G (250 psi).

3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

C. Dry Pipe Valve: Vertical style with grooved ends, cast iron body, replaceable clapper facing with right or left hand trim and controls for automatic operation.

1. Trim:

a. Main drain and valve.

b. Gauges with gauge cocks.

c. Galvanized pipe and trim fittings.

d. Low air and waterflow alarm switches.

e. Automatic air pressure maintenance device.

f. Air relief valve set at 5 psi in excess of maximum pressure that should be on system.

g. Water motor gong.

h. Anti-flooding type accelerator with trimmings.

2. Design Equipment: Reliable Model A (2-1/2 in.), or Model D (4 in. and 6 in.).

3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

## 2.05 SPRINKLERS AND ACCESSORIES

A. Brass or bronze, 1/2 in. orifice, 1/2 in. NPT. 165°F ordinary temperature classification for light and ordinary hazards. Use 286°F sprinklers in Mechanical, Electrical and Elevator Rooms; in vicinity of heat equipment/sources; and in accordance with NFPA 13.

1. Finished Ceiling Areas: Concealed pendent sprinklers with matching coverplate, color as selected by Architect.

2. Unfinished Ceiling Areas: Natural brass/bronze finish pendent or upright sprinklers as required.

B. Sprinkler Types and Design Equipment:

1. Quick Response Pendent and Upright: Reliable Model F1FR.
2. Quick Response Concealed Pendent: Reliable Model G4A.
3. Quick Response Horizontal Sidewall: Reliable Model F1FR-HSW1.
4. Quick Response Dry Pendent and Horizontal Sidewall: Reliable Model F3QR.
5. SSP and SSU: Reliable Model F1.
6. Concealed Pendent: Reliable Model G4.
7. Horizontal Sidewall: Reliable Model F1-HSW1.
8. Dry Pendent and Horizontal Sidewall: Reliable Model F3.
9. Quick Response Extended Coverage Pendent: Reliable Model F1FR.
10. Quick Response Extended Coverage Concealed Pendent: Reliable Model G4 XLO QREC.
11. Quick Response Extended Coverage Horizontal Sidewall (Type A): Reliable Model F1FR EC-8.
12. Quick Response Extended Coverage Horizontal Sidewall (Type B): Reliable Model DH 56.
13. Intermediate Level Upright and Pendent: Reliable Model F1.
14. Corrosion Resistant: Furnish with factory applied wax or lead plating. Do not disrupt during installation.
15. Early Suppression, Fast Response Upright: Tyco Model ESFR-17/16.8 K-Factor.

C. Flexible Sprinkler Drops:

1. FM Approved braided Type 304 stainless steel tube with union joints, factory tested to 400 psi and listed for up to three (3) 90° bends including bracket for mounting to ceiling or building structure.
   a. Design Equipment: Victaulic "VicFlex".

D. Sprinkler Guards:

1. Steel wire cage with base plate and retaining clamps. Same manufacturer as sprinkler.
2. Design Equipment: Reliable Model C-1.

E. Sprinkler Cabinets and Spare Sprinklers:

1. Steel or aluminum construction with shelves and shell holes to accommodate the number of spare sprinklers required by NFPA 13.
2. Bright red finish with hinged front door and label.

3. Sprinkler wrenches compatible for each type used.
4. Spare sprinklers for each system of the type and proportion of those used in each system.
5. Design Equipment: Reliable Model A-4.

F. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

2.06 ALARM EQUIPMENT

A. Waterflow Pressure Switch:
1. Pressure activated waterflow alarm switch with retard, steel enclosure and cover, adjustable differential type, SPDT contacts, 24 volt DC, 1/2 in. pressure connection, 250 psi rated.
2. Design Equipment: Potter Electric #WFSR-F.

B. Air Pressure Supervisory Switch:
1. For remote low air pressure supervisory alarm and for air compressor operation, steel enclosure and cover, adjustable differential type, SPDT contacts, 24 volt DC, 1/2 in. pressure connection compatible with system devices, 250 psi rated.
2. Design Equipment: Potter Electric #PS40A.

C. Paddle Waterflow Detectors:
1. Adjustable retard feature, SPDT contacts, 24 volt DC, 250 psi rated.
2. Design Equipment: Potter Electric #VSR Series.

D. Tamper Switches:
1. Integral with valve or separate device installed on valve to actuate alarm upon valve movement, steel enclosure, SPDT contacts, 24 volt DC, mounting brackets and hardware.
2. Design Equipment: Potter Electric #OSYSU (for OS&Y valves) and #PIVSU-A (for post indicator and butterfly valves).

E. Acceptable Manufacturers: Autocall, Potter Electric, System Sensor or approved equal.

2.07 INSPECTOR'S TEST EQUIPMENT

A. Test and Drain Valve:
1. Combined test and drain valves, sight glass and interchangeable restricting orifice, sized for smallest orifice in sprinkler zone.
2. Design Equipment: AGF Manufacturing "Test and Drain".
3. Acceptable Manufacturers: AGF Manufacturing, Viking, Victaulic or approved equal.

B. Remote Flow Detection and Test Assembly:

1. Bronze body sized as required by NFPA 13 with threaded connections, brass stem, impregnated Teflon seat, chrome coated brass ball, steel handle with positive stops at the test and drain positions, tamper resistant test orifice, integral tamper resistant sight glasses, tapped and plugged port for system access and steel identification plate. Assembly shall be rated for 300 psi working pressure.
2. Test orifice size shall match the smallest orifice installed on the system.
3. Solenoid Valve:
   a. 24V DC, or 120V AC.
   b. Pressure Rating: 300 psig.
4. Bypass Drain Loop Kit connecting the solenoid valve outlet to the bypass drain port.
5. Locking Plate Kit to provide vandal resistance and prevent accidental alarm activation by locking the valve handle in the "OFF" position with carbon steel locking plate, 1-1/2 in. wide solid brass lock with 3/8 in. chrome plated hardened steel shackle.
6. Assembly shall comply with UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide" as well as the requirements of NFPA 13, NFPA 70 and NFPA 72.
7. Design Equipment: AGF Manufacturing, Inc. Model 1200 Remote Test and Drain.
8. Acceptable Manufacturers: AGF Manufacturing, Inc. or approved equal.

## 2.08 MANUAL AIR VENTS

A. Manual air vent shall include 1 in. isolation valve with forged brass body, stainless steel 20 mesh strainer, ball float, hose connection, threaded cap and lanyard.

1. Design Equipment: AGF Manufacturing, Inc. Model 7910MAV.
2. Acceptable Manufacturers: AGF Manufacturing, Inc. or approved equal.

## 2.09 AUTOMATIC AIR VENTS

A. Automatic air vent shall include 1 in. NPT isolation valve with forged brass body and stainless steel 20 mesh strainer, adjustable purge valve with hose connection, threaded cap and lanyard and automatic air release valve with conical body, recessed venting valve, single float on rigid shaft and bubble breaker.

B. Provide with end cap and close nipple (AGF Model 7930ECA).

1. Design Equipment: AGF Manufacturing, Inc. Model 7900AAV.
2. Acceptable Manufacturers: AGF Manufacturing, Inc. or approved equal.

2.10 SYSTEM COMPONENT IDENTIFICATION

A. At control, test and drain valves, provide permanently marked identification signs constructed of 18 gauge steel with baked enameled finish. The signs shall be permanently mounted on the piping or wall at the valve, or on the valve, but shall not be hung on the valve with wires or chains which permits easy removal of the sign. The sign shall clearly indicate the valve's purpose and what portion of the structure it serves. Additional signs, shall be provided at each alarm check and dry pipe valve to clearly indicate hydraulic calculation data.

2.11 ADDITIONAL SPRINKLERS AND SPRINKLER GUARDS

A. Include allowance for providing 10 additional sprinklers with related piping, fittings, hangers and 10 additional sprinkler guards installed at locations where job conditions or equipment selections may be required. Provide a credit for sprinklers and guards not installed.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.

B. Piping shall not pass directly over electric panelboards, switchboards, motor control centers, and similar electric and telephone equipment. However, protection for these spaces shall be provided.

C. Piping shall be installed concealed above finish ceiling area with sprinklers located in the center of ceiling tiles where ceiling tiles are used.

D. Provide a readily removable flushing connection consisting of a cap at each end of cross mains.

E. Each sprinkler system shall be provided with an automatic vent valve located near the high point of the system in accordance with NFPA requirements.

F. Provide sprinkler guards for sprinklers in mechanical and storage spaces, less than 8 ft. above finished floor subject to mechanical damage.

G. Pipe ball drip valves at a floor drain or to the exterior. Pipe 2 in. main drains and water motor gong drains to discharge to the exterior at approximately 2 ft. above finished grade.

H. Securely install the spare sprinkler cabinets to the building wall at the main riser.

I. Inspector's test valves and dry system auxiliary drains shall be installed 7 ft. or less above the finished floor.

J. Fire department connections shall be installed 3 ft. above finished grade and water motor gongs approximately 10 ft. above finished grade.

K. Upright sprinklers directly on branch lines shall be installed with their frame parallel to the piping.

L. Provide sprinkler protection under ductwork, groups of ductwork and other obstructions to water spray and distribution. Use intermediate level sprinklers if subject to waterspray from above.

M. Exposed pipe shall be left clean for painting.

N. Coordinate and activate the systems or portions of the system to operational status as soon as possible.

3.02 PIPING, VALVES AND HANGERS

A. Refer to other applicable sections.

B. All piping shall be installed to permit drainage of the system through a main drain valve. Where a change in piping direction prevents drainage of the system, auxiliary drains shall be provided. The auxiliary drain assembly shall consist of a lockable ball valve, nipple and cap or plug and shall be located 7 ft. or less above the finished floor. Pipe drain to an accessible location.

3.03 TESTS

A. General:

1. Pipe installation shall be inspected by Owner's Representative prior to being covered by building construction or backfill.

2. Give the Owner's Representative advance notice of final tests. Perform tests in a safe manner. Provide written certification that tests have been successfully completed. Use NFPA Above and Below Ground Material and Test Certificate Forms.

3. Correct system leaks prior to final test. Do not utilize water additives, caulking, etc. to correct leaks. Provide appliances, equipment, instruments, devices and personnel.

4. Flushing: Follow Contract Documents and utilize open end pipe sections if possible.

B. Pressure Tests:

1. Hydrostatic Tests: Minimum 200 psi and in accordance with NFPA 13 for two (2) hours.

a. Air test not accepted as final test.

2. Air Test: Minimum 40 psi for 24 hours with loss not to exceed 1.5 psi within 24 hour duration.

3. Do not subject existing systems to excess pressures.

C. Alarm Tests:

1. Demonstrate activation of alarms and operational trip test and water delivery time for dry systems by use of Inspector's test valve.

3.04 SYSTEM TURNOVER

A. Prior to final acceptance, instruct the Owner's Representative in the proper operation, maintenance, testing, inspection and emergency procedures for all systems furnished, for a period of time as needed. Provide one (1) new original pamphlet of NFPA 25. Indicate in writing to the Owner's Representative the provisions for proper maintenance, testing, and inspection of the systems as required by local fire codes.

END OF SECTION

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SECTION 21 24 00

FUEL ISLAND FIRE SUPPRESSION SYSTEM

(ADD ALTERNATE 2)

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers design, furnishing and installation of a dry chemical fire suppression system at a gasoline and diesel dispensing island, plus all associated piping, fittings, electrical connections, switches, appurtenances, permitting, and testing required to provide a complete and operable system.

1.02 RELATED WORK:

A. Section 33 56 13, Aboveground Fuel Storage Tanks

C. Section 28 09 50, Fuel Dispenser and Management System

D. Division 26, Electrical

1.03 REFERENCES:

A. The following standards form a part of this specification and indicate the minimum standards required:

National Fire Protection Association (NFPA)

| | |
|---|---|
| NFPA 17 | Standard for Dry Chemical Extinguishing Systems |
| NFPA 30 | Flammable and Combustible Liquids Code |
| NFPA 30A | Code for Motor Fuel Dispensing Facilities and Repair Garages |

New York Building Code and Fire Prevention Regulations

1.04 SUBMITTALS: IN ACCORDANCE WITH THE REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop drawings, details, data sheets, and other descriptive drawings and materials as may be required to fully describe the equipment proposed and to verify conformance with the Contract Documents. Also submit copies of Operation & Maintenance Manuals, train the Owner how to use and operate the system, and advise on periodic testing requirements.

B. Contractor shall provide detailed fire suppression system engineering drawings stamped by a New York Professional Engineer. Contractor is responsible for paying for and obtaining all permits.

C. Two copies of permits and the written results of all tests conducted in the presence of the local Fire Department, allowing operation of the system.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. The system shall be a Pre-Engineered Type and shall be designed to meet UL1254 and NFPA 17 requirements for a Dry Chemical Extinguisher System. The system shall be UL 1254 listed.

B. The system shall be designed to provide required fire suppression for the pump island shown on the Drawings. The system shall provide protection for the complete hazard protection area, as defined by the area within reach of the fuel dispenser hoses.

C. The fire suppression system shall be a manufactured by PEM-ALL, Pyrochem, Kidde, or approved equal.

D. Dry chemical cylinders shall be securely mounted to the fire suppression support frame as shown on the drawings. Actual cylinder size and number shall be determined by the manufacturer to meet UL1254 and code requirements.

E. Operating parts shall include nitrogen bottle switch system, main nozzles and high flow nozzles, 190º F thermostats to automatically activate the fire suppression system, and three manual pull stations as shown on the Drawings. Actual nozzle and thermostat locations and quantities shall be determined by the manufacturer. Nozzles shall not extend below 11-feet above finished grade to allow for sufficient truck clearance and shall not be activated by truck exhaust heat. The thermostats shall be installed generally as shown on the Drawings and in accordance with manufacturer recommendations. The nitrogen bottle and system control panel shall be located within the Directors office shown on the Drawings, and the conduit carrying the nitrogen shall be in accordance with the manufacturer recommendations and shall be placed in a galvanized rigid steel conduit suitable for direct bury with 12-inches of compacted gravel all around meeting the subgrade piping requirements on the fuel equipment drawings and at sufficient depth to protect it from H-20 wheel loads. The nitrogen line shall be installed so that it can be replaced in the future if needed without having to dig up the line.

F. System shall be automatically activated using the 190º F thermostats and shall be manually activated using the remote electrical pull stations, as shown on the Drawings. A mechanical override shall be part of the system in event of a power outage. The system activation switch shall be connected to the fuel pump emergency shut-off

switches so fuel pumps and all power to the fuel island are deactivated automatically when the fire suppression system is activated either manually or automatically. The manual pull stations shall be marked with a sign indicated "EMERGENCY PUMP SHUTOFF - FIRE SYSTEM RELEASE" consisting of block letters not less than 2-inches in height in red letters on a white background. The fire release system switch shall be weatherproof and placed within a weatherproof enclosure (NEMA 4X) in accordance with the manufacturer's recommendations. In addition, all components of the fire suppression system shall be weather and corrosion proof as appropriate. The system shall be tied into the building fire alarm system to notify the fire department in the event the system has been activated. The fuel system Contractor shall perform all work necessary to provide a complete and operable system.

G. System shall include thermal detection, pneumatic release, pressure switches, fire alarm panel, control panel, and all other components necessary to provide a complete working system.

H. Contractor shall provide electrical service and connections, as required by the manufacturer. Heat sensors, strobe horn, pull station, and control panels shall require single phase, 120 volt power supply.

I. All agent piping shall be threaded Schedule 40 hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall apply for, pay for, and secure all permits required by the work of this section.

B. The system shall be installed on the fire suppression support system in accordance with instructions provided by the manufacturer.

C. System shall be installed by a contractor certified by the manufacturer.

D. The general scope of the fire suppression system is shown on the Drawings and described herein and not all components are specified. The Contractor shall provide all equipment, materials, and equipment necessary for a complete, operable, code compliant, and permitted system, and meeting the manufacturer's recommendations.

3.02 TESTING:

A. The Contractor shall notify the Engineer when the installation has been completed and shall perform all required testing in the presence of and to the satisfaction of the local Fire Department.

B. Following completion of all required testing, the system shall be left fully charged and ready for operation.

END OF SECTION

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SECTION 22 05 13
MOTORS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

## PART 2 - PRODUCTS

2.01 MOTORS

A. General Requirements:

1. Motors built for 60 Hz operation, three phase for 1/2 HP and larger; single phase for 1/3 HP and smaller. In compliance with NEMA Standards, wound specifically for nameplate voltage, and selected for appropriate duty and environment. 1.15 minimum service factor at rated voltage and frequency. Bearings rated 20,000 life hours. V-belt connected motors with adjustable slide rail bases and pulleys. Motors shall have Class F insulation system, with Class B temperature rise. Maximum allowable motor temperature rise for open drip-proof or totally enclosed fan cooled (TEFC) type at 1.15 service factor shall be 80°C above 40°C ambient up to 300 HP. NEMA locked rotor kVA code as required to match unit equipment torque characteristics. Single-phase motors shall be capacitor start, induction run, or split phase type. Polyphase motors shall be constant speed, squirrel cage, unless otherwise called for. Nameplates shall have as a minimum, all information as described in NEMA Standard MG-1-20.60.

2. Motors for use with variable speed drive applications shall be inverter duty rated in accordance with NEMA. These motors shall meet NEMA corona inception voltage requirements, withstanding peak voltages up to 1600 volts, and be manufactured in accordance with NEMA MG-1 Part 31.

3. EC Motors:

a. The motor shall be DC rated with permanent magnet rotor and automatically resetting integral overload protection.

b. The unit shall meet the scheduled voltage, phase, control and other requirements indicated.

c. Input Control: The unit shall have the following control features as a minimum:

1) Packaged Unit Controls: DDC input to include start/stop/status/general trouble.

2) External Control: Minimum of Modbus and/or BACnet digital start/stop, digital trouble, 0-10VDC and 4-20mA speed control input.

d. Unit insulation shall be Class H.

e. Electrical termination lugs shall be suitable for the intended feed circuit.

f. Ratings shall be 90% minimum power factor and 10% maximum total harmonic distortion.

g. Speed control suitable for 100% to 10% operational capability.

h. Fully programmable and reviewable settings and parameters.

i. Suitable for operation at ambient conditions of 32 to 104 degrees F.

j. The power circuiting shall be separated from the low voltage control circuiting.

k. Output parameters where indicated:

1) Speed.

2) Trouble indication.

3) Overload indication.

4. Three phase motors rated 1 HP and greater shall be special design, copper winding, relubable ball bearings, 1.15 service factor, premium efficiency, energy-saver type with a guaranteed NEMA nominal full-load efficiency, by IEEE Standard 112 Test Method "B". Motors to have three-year warranty. Efficiency rating shall appear on nameplate, and shall be not less than as follows:

| **MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY** | | | | | | |
|---|---|---|---|---|---|---|
| **HP** | **OPEN MOTORS (RPM)** | | | **CLOSED MOTORS (RPM)** | | |
| | **1200** | **1800** | **3600** | **1200** | **1800** | **3600** |
| 1.0 | 82.5 | 85.5 | 77.0 | 82.5 | 85.5 | 77.0 |
| 1.5 | 86.5 | 86.5 | 84.0 | 87.5 | 86.5 | 84.0 |
| 2.0 | 87.5 | 86.5 | 85.5 | 88.5 | 86.5 | 85.5 |
| 3.0 | 88.5 | 89.5 | 85.5 | 89.5 | 89.5 | 86.5 |
| 5.0 | 89.5 | 89.5 | 86.5 | 89.5 | 89.5 | 88.5 |
| 7.5 | 90.2 | 91.0 | 88.5 | 91.0 | 91.7 | 89.5 |
| 10 | 91.7 | 91.7 | 89.5 | 91.0 | 91.7 | 90.2 |

| MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY | | | | | | |
|---|---|---|---|---|---|---|
| HP | OPEN MOTORS (RPM) | | | CLOSED MOTORS (RPM) | | |
| | 1200 | 1800 | 3600 | 1200 | 1800 | 3600 |
| 15 | 91.7 | 93.0 | 90.2 | 91.7 | 92.4 | 91.0 |
| 20 | 92.4 | 93.0 | 91.0 | 91.7 | 93.0 | 91.0 |
| 25 | 93.0 | 93.6 | 91.7 | 93.0 | 93.6 | 91.7 |
| 30 | 93.6 | 94.1 | 91.7 | 93.0 | 93.6 | 91.7 |
| 40 | 94.1 | 94.1 | 92.4 | 94.1 | 94.1 | 92.4 |
| 50 | 94.1 | 94.5 | 93.0 | 94.1 | 94.5 | 93.0 |
| 60 | 94.5 | 95.0 | 93.6 | 94.5 | 95.0 | 93.6 |
| 75 | 94.5 | 95.0 | 93.6 | 94.5 | 95.4 | 93.6 |
| 100 | 95.0 | 95.4 | 93.6 | 95.0 | 95.4 | 94.1 |
| 125 | 95.0 | 95.4 | 94.1 | 95.0 | 95.4 | 95.0 |

(The above efficiency levels are in compliance with the NYSERDA Smart Equipment Choices Program PON 912, which expires 12/31/05.)

5. Nominal Motor Voltage Table:

| Nominal System Voltage | Motor Nameplate |
|---|---|
| 480V - 3 phase | 460 volt |
| 277V - 1 phase | 265 volt |
| 240V - 1 phase and 3 phase | 230 volt |
| 208V - 1 phase and 3 phase | 200 volt |
| 120V - 1 phase | 115 volt |

6. Motor Application:

| Environment/location | Motor Enclosure Type |
|---|---|
| General Purpose | Open Drip-proof, TEFC or encapsulated |

| | |
|---|---|
| Outdoors, below grade or high humidity areas, pool filter rooms | TEFC |
| Hazardous | Explosion-proof |

7. Make: Need not be all of same make, but one of the following: General Electric, Gould, Reliance, Westinghouse.

**PART 3 - EXECUTION**

3.01 MOTORS

A. Furnished by equipment manufacturer and especially manufactured and/or selected, mounted, and installed for intended use. Install motors accessible for maintenance and belt adjustment.

END OF SECTION

SECTION 22 05 23
VALVES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.02 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

## PART 2 - PRODUCTS

2.01 VALVES - GENERAL

A. Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.
2. Stem packing serviceable without removing valve from line.
3. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

B. Acceptable Manufacturers:

1. Balance Valves: Armstrong, Bell & Gossett, Red White, Taco, Tour and Anderson.
2. Ball Valves: Apollo, Hammond, Milwaukee, Nibco, Red White, Watts.
3. Gate and Check Valves: Hammond, Milwaukee, Nibco, Red White, Stockham, Watts.
4. To establish a standard of quality and identify features, certain manufacturer's numbers are given in the following paragraphs.

2.02 DOMESTIC WATER VALVES

A. Gate Valves:

1. 4 in. and Larger, Hot Water Service: IBBM, solid wedge disc, OS&Y, flanged ends, 125 SWP; Milwaukee F-2885.
2. 4 in. and Larger, Cold Water Service: Epoxy coated, resilient wedge, OS&Y, flanged ends, 175 wwp, UL/FM; Watts 408 RW.

3. 3 in. and Smaller: Bronze, solid wedge disc, rising stem, 125 SWP; Milwaukee 1152 (threaded ends, union bonnet) or Milwaukee 149 (sweat ends, threaded bonnet.)

B. Check Valves:

1. 3 in. and Larger: IBBM, renewable seat and disc, bolted flange cap, flanged ends, 125 SWP; Milwaukee F-2974.

2. 2 in. and Smaller: Lead-free swing check with silicone bronze body, bonnet and trim, PTFE disc seat and stainless steel seat disc washer, 200 psi working pressure, Nibco T-413-Y-LF (threaded) or Nibco's S-413-Y-LF (solder).

3. Silent Type: Lead-free spring check with silicone bronze body, stainless steel trim and PTFE disc: 250 psi working pressure; Nibco T-480-4-LF (threaded) or Nibco S-480-Y-LF (solder).

C. Ball Valves:

1. 2-1/2 in. and Larger: Lead-free, forged copper silicon 2-piece body, chrome plated brass ball, full port, teflon seats and stem packing, separate packing and handle nut, blowout proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 125 WSP; Watts LF-FBV-3C Series (threaded ends) or Watts LF-FBVS-3C series (sweat ends).

2. 2 in. and Smaller: American-made, lead-free, bronze 2-piece body, chrome-plated lead-free brass ball, lead-free brass stem, full port, teflon seats and stem packing, separate packing and handle nut, blow out proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 150 SWP: Watts #LFB-6080G2 (threaded ends) or Watts #LFB-6081G2 (sweat ends).

D. Balance Valves:

1. 2 in. and Smaller: Lead-free, brass body, chrome plated brass ball, glass and carbon filled PTFE seat rings, Viton packing, threaded or solder ends, differential readout ports, calibrated nameplate and memory stop indicator rated for 125 psi; and pre-formed insulation to permit access for balancing and readout; Watt Series LFCSM-61-S.

a. Balance valve sizes shall be based upon gpm range rather than pipe size.

| Balance Valve Size | GPM Range |
|---|---|
| 1/2 in. | Up to 2.5 |
| 3/4 in. | 2.5 - 4.5 |
| 1 in. | 4.5 - 10 |
| 1-1/4 in. | 10 - 15 |
| 1-1/2 in. | 15 - 30 |
| 2 in. | 30 - 60 |

F. Pressure Reducing Valves:

1. Direct Operated for Cold Water Service:

   a. Bronze body construction, renewable stainless steel seat, reinforced Buna-N diaphragm and valve disc integral strainer, adjustable reduced pressure range, for dead end service.

   b. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

2. Pilot Operated for Cold Water Service:

   a. Globe or angle pattern, flanged ends, epoxy coated, ductile or cast iron body, bronze seat, stainless steel trim, hydraulically operated, diaphragm actuated, pilot controlled, adjustable pressure settings, pressure gauges, UL labeled, minimum 150 psi WWP for entire assembly.

   b. Acceptable Manufacturers: Watts, Bermad, Spence or approved equal.

3. Direct Operated for Hot Water Service:

   a. Water Wash Hoods: Same as cold water except with built-in by-pass option; outlet set at 40 psi, rated at 160°F.

   b. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

G. Valves for Gauges and Instruments:

1. 1/2 in. Size: Brass bar stock for 1000 psi and 300°F; Trerice No. 735 needle valve.

H. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #LFFBV/FBVS-3C-CC.

## 2.03 GAS VALVES

A. Plug Valves:

1. 2-1/2 in. thru 6 in.: Semi-steel body and plug, short pattern, 100% pipe area rectangular port, lubricated plug, wrench operated with handle, sealing compound suitable with natural gas, flanged ends, 200 WOG, UL listed for natural gas; Homestead Figure 602.

2. 6 in. thru 12 in.: Semi-steel body and plug, short pattern, 100% pipe area round port, full bore lubricated plug, gear operated with handle, sealing compound suitable with natural gas, flanged ends, 200 WOG, UL listed for natural gas; Homestead Figure 652-G.

B. Ball Valves:

1. 2 in. and Smaller: Ball type, two-piece, full port, brass body with chrome plated brass ball, teflon seats, threaded ends, 600 psi WOG, UL listed for natural gas, Watts FBV-3C-UL.

2.04 UNDERGROUND VALVES AND ACCESSORIES

A. Gate Valves 3 in and Larger: IBBM, inside screw-in, wedge disc, resilient seat, "O" ring seals, 175 WWP, open counter-clockwise, 2 in. square wrench nut, mechanical joint ends, AWWA C509, UL listed, FM approved.

B. Curb Valves 2 in., and Smaller: Brass plug valve, one quarter turn with check, solid teehead "O" ring seal, flared copper ends, 175 WWP; Mueller #H-15201.

C. Curb Boxes: Cast iron with adjustable steel riser, stationary rod and cover extending from the valve to finish grade. Provide with each curb valve.

D. Valve Boxes: Cast iron adjustable screw type box and cover extending from the valve to finish grade. Cast arrow and lettering on cover of box denoting direction of valve opening and service. Provide with each curb valve.

E. Valve Key: Steel socket key for gate valve or curb valves.

F. Post Indicator Assembly: UL/FM for fire protection service only; sufficient shaft length for tope of valve to be approximately 36 in. above finished grade, case hardened brass padlock and keys.

2.05 SANITARY DRAINAGE VALVE

A. Gate Valves:

1. 2-1/2 in. and Larger: IBBM, solid wedge disc, OS&Y, flanged ends, 125 SWP; Milwaukee F-2885.

2. 2 in. and Smaller: Bronze, solid wedge disc, rising stem, 125 SWP; Milwaukee 1152 (threaded ends, union bonnet) or Milwaukee 149 (sweat ends, threaded bonnet.)

B. Check Valves:

1. 3 in. and Larger: Cast iron body, epoxy coated, sinking metal ball type check, access port for cleanout, flanged connections, stainless steel fasteners; Flomatic Model 408, or GA Industries.

2. 2-1/2 in. and Smaller: Cast iron body, epoxy coated, sinking ball type check, two bolt access cover for cleanout, replaceable Buna-N valve seat; Flomatic Model 508, or GA Industries.

C. Backwater Valves:

1. Type A, 2 in. through 8 in.: Flap type on hinge with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, disc and seat shall be bronze. Set position of disc to be slightly opened. Threaded cover with countersunk plug; Jay R. Smith Figure 7022S.

2. Type B, 2 in. through 8 in.: Flap type on hinge with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, disc and seat shall be bronze. Set position of disc to be slightly opened. Bolted cover with stainless steel bolts; Jay R. Smith Figure 7012S.

3. Type C, 2 in. through 6 in.: Drain outlet type, cast iron body with ball float, neoprene seat with removable bronze ring; Jay R. Smith Figure 7080.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide all shutoff, check, balancing and other type valves as indicated, as required by Code and as required for proper system maintenance, isolation and safety. Provide at major building and systems sections. Provide shutoff valves on all branch lines serving two fixtures or more, at all equipment, fixtures, before and after automatic control valves, and at future connections.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide drain valves with hose thread connections on all equipment. Provide hose thread drain valves at all low points to enable complete drainage of all piping systems including, water mains, branches, at base of vertical risers and at strainers.

D. Provide shutoff valve and wye-strainer before all automatic control valves and pressure reducing valves.

E. Inspect valves for proper operation before installation. Install underground valve boxes vertically over each valve. Adjust top of box to proper grade. Immediately backfill with crushed stone and carefully tamp into place. Unless otherwise noted, leave in the open position.

3.02 DOMESTIC WATER SYSTEM

A. The main water service shutoff valve inside the building and valves for a 3 in. and larger water meter assembly shall be OS&Y gate valves in accordance with the local water authority requirements.

B. Install balance valves in each hot water circulation branch and where noted.

3.03 NATURAL GAS SYSTEM

A. Ball valves shall be UL listed for use in natural gas systems, or certified by another acceptable third-party testing agency.

END OF SECTION

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SECTION 22 05 40
ELECTRIC WIRING

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of motor control wiring and instrumentation control wiring as required in Contract Documents. Provide wiring and conduit, required to connect devices furnished as part of or adjunctive to the system and for motor control regardless of the source of supply. Control wiring includes 120 volt and lower voltage wiring for control signals directing equipment operation. Control circuits shall be 120 volt maximum. Provide wiring in accordance with requirements specified in Division 26, "Electrical" and the National Electrical Code. Provide devices required for proper system operation, including special electrical switches, transformers, disconnect switches, relays, and circuit breaker protection.

B. Coordinate all work with Division 26, "Electrical".

1.02 WORK NOT INCLUDED

A. Power wiring for motors, motor starters and associated starting and control equipment, as well as the motor starters (except in the case of equipment specified to have packaged controls/starters), are included in Division 26, "Electrical", unless otherwise called for.

1.03 QUALIFICATIONS

A. Wiring installed in compliance with all requirements of Division 26, "Electrical".

1.04 SUBMITTALS

A. Provide complete wiring diagrams for equipment and systems. Deliver wiring diagrams to proper trades in time for roughing of conduit, equipment connections, and avoid delay in construction schedule. Wiring diagrams and roughing information to be wired as part of the Work of Division 26, "Electrical", shall be clearly indicated.

## PART 2 - PRODUCTS

2.01 PRODUCTS

A. Refer to Division 26 specifications for required wiring materials.

## PART 3 - EXECUTION

3.01 GENERAL

A. Check electrical wiring pertaining to equipment for completeness and correctness of connections. Correct any misapplied motor and/or motor starter, improper

thermal overload device, or device which fails to function and resultant damage, whether due to incorrect connections or improper information on wiring diagrams.

3.02 WIRING FOR CONTROL SYSTEMS

A. Provide motor control and instrumentation wiring for equipment. All wiring shall be in conduit, unless otherwise noted. Refer to Section 260501 for type of conduit to be used in specific applications. Provide 18 in. length flexible conduit at motors and devices subject to vibration. Conduit supported on 5 ft. centers. Do not attach directly to hot surfaces, piping, or ductwork. Control wiring shall be in separate conduit from all other wiring. Provide green grounding wire circuited from starter, and run ground wire through conduit to each remote auxiliary relay, pushbutton station, remote panel heating device, thermostat, or device with potentials in excess of 50 volts. Size ground wire as required by NEC.

B. Provide pushbutton stations, pilot lights, selector switches, auxiliary starter contacts, and other devices required to provide specified functions.

C. Where allowable by Code and contract documents, control wiring may be installed without conduit. Installation and wire insulation types shall be as described by NEC, Article 725. All low voltage wiring circuits 50V and under shall:

1. Be adequately supported using bridle rings or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.
2. Be run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.
3. Be installed in conduit when installed vertically in Mechanical Rooms from panels and devices up to ceiling.
4. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.
5. Have the proper insulation and meet the requirements of NEC Article 300-22 when installed in plenums or other spaces used for environmental air.

3.03 EQUIPMENT WIRING

A. Provide power and control wiring between shipping splits, and between remote panels, thermostats, disconnect switches, and their respective units. Provide control wiring from the package control system, to each respective motor or device. Properly mount control package. Power wiring to and including disconnect switch shall be by Division 26, "Electrical".

3.04 FIELD WIRING IN STARTERS, CONTROLLERS, AND PANELS

A. Wiring within starters, controllers, and panels, shall be routed neatly in gutter space, away from moving and/or heat producing parts. Provide 30 ampere, 600

volt rated terminal blocks. Do not place more than two wire connections on pilot device or relay terminal. Where more than two circuit connections are required, use terminal blocks. Provide nylon self-insulated, locking type spade lugs for all control wires. Cables and wires shall be neatly bundled and lashed with nylon cable straps.

END OF SECTION

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SECTION 22 05 53
PLUMBING IDENTIFICATION

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 QUALIFICATIONS

A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.03 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating valve number, location and valve function. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

1.04 MAKES

A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Industrial Safety Supply Co., Inc., Seton Name Plate Corp.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.02 PIPING IDENTIFICATION

A. Identification Types:

1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

B. Lettering:

1. Piping labeling shall conform to the following list:

| PIPE FUNCTION | IDENTIFICATION |
|---|---|
| Cold Water | DOMESTIC COLD WATER |
| Hot Water | DOMESTIC HOT WATER |
| Hot Water Recirculating | DOMESTIC HOT WATER RECIRCULATING |
| Pump Discharge | PUMP DISCHARGE |
| Natural Gas | NATURAL GAS |
| Compressed Air | COMPRESSED AIR |
| Exhaust Air | EXHAUST AIR |

2.03 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between heating and plumbing services with 1/4 in. letters above the valve number.

2. Acceptable Manufacturers: Seton Style No. M4507, or approved equal.

B. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.04 EQUIPMENT IDENTIFICATION

A. General:

1. Provide engraved vinyl nameplates for each major piece of mechanical equipment provided, 2-1/2 in. x 3/4 in. size.

2. Acceptable Manufacturers: Seton Style No. M4562, or approved equal.

2.05 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.

B. The color for all plumbing valves shall be BLUE.

## PART 3 - EXECUTION

3.01 GENERAL

A. Provide valve tags for all valves provided on project.

B. Provide equipment tags for all equipment provided on project.

C. Provide piping identification with directional flow arrows for all piping on project, maximum intervals of 20'-0". For piping installed through rooms, provide at least one (1) pipe label in each room, for each pipe function.

END OF SECTION

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SECTION 22 05 54
PAINTING

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each coating.

1. Material analysis including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.
2. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods.

1.03 QUALITY ASSURANCE

A. Materials:

1. All coating materials required by this section shall be provided by a single manufacturer, unless otherwise required or approved.
   a. Contractor: Firm with successful experience in painting work similar in scope of work of this project.
   b. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

1.04 GENERAL

A. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

## PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design Make:

1. Sherwin Williams Company.

B. Acceptable Makes:

1. Devoe & Raynolds Company.
2. The Glidden Company.
3. Benjamin Moore & Company.
4. PPG Industries, Inc./Pittsburgh Paints.

5. Pratt & Lambert, Inc.
6. Sherwin Williams Company.

2.02 PRODUCTS

A. Colors:
1. As selected by Owner.

B. Lead Content:
1. Not more than 0.06 percent lead by weight (calculated as lead metal) in the total nonvolatile content of the paint or the equivalent measure of the lead in the dried film.

**PART 3 - EXECUTION**

3.01 INSPECTION

A. Verify that surfaces and conditions are ready for work in accordance with coating manufacturer's recommendations.

B. Prior to commencement of work, examine surfaces scheduled to be finished.

C. Report any unsatisfactory conditions in writing.

D. Do not apply coatings to unsatisfactory substrates.

E. Beginning painting work on an area will be deemed construed acceptance of surfaces in that area.

3.02 SCOPE

A. Plumbing components shall be painted by the Plumbing Contractor.

B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. See schedule for color code.

C. Paint all hangers, rods and any other bare iron work in all exposed areas.

D. Paint all exterior metal or iron including all piping, supporting metals, etc, unless furnished with a factory finish. This shall include galvanized steel. Paint with galvanized primer and finish with epoxy of color selected by Architect. Exterior metal painting shall include all exposed plumbing piping, fittings, valves, etc.

E. Paint bare metal and touch up damaged finish on all plumbing equipment. Use heat resistant paint on all hot surfaces.

F. Paint all insulated and bare piping exposed to view in all areas.

G. Paint all uninsulated water pump casings and piping connections.

H. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contact must be touched up by Contractor responsible for same.

3.03 SURFACE PREPARATION

A. Apply coatings to surfaces that are clean and properly prepared in accordance with manufacturer's instructions and as herein specified. Remove dirt, dust, grease, oils and foreign matter. Prepare surface for proper texture necessary to optimum coating adhesion and intended finished appearance. Plan cleaning, preparation, and coating operations to avoid contamination of freshly coated surfaces.

B. Provide protection for non-removable items not called for coating. After application of coatings, installed removed items. Use only skilled workmen for removal and replacement of such items.

C. Protect surfaces not called for coating. Clean, repair, or replace to the satisfaction of the Engineer/Owner's Representative any surfaces inadvertently spattered or coated.

D. Metal Work:

1. Remove all oil and grease with non-flammable solvent. Remove all rust with steel wool.
2. Patched Areas, Touch-up Areas. Clean and prepare all surfaces as required to provide a smooth, even substrate for proper application of finish.
3. Contractor must examine areas and conditions under which paint is to be applied and notify Engineer in writing if conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.04 APPLICATION

A. General:

1. Apply coatings in accordance with coating manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.
2. Apply successive coats after adequate cure of the preceding coat and within the recommended recoating time.
3. Complete coatings shall be free of defects such as runs, sags, variations in color, lap or brush marks, holidays, and skips.

B. Remove coatings not in compliance with this specification, reclean and re-prepare surfaces as specified, and apply coatings to comply with the Contract Documents.

3.05 SCHEDULE OF COATINGS FOR METAL SURFACES

A. Porous Surface:

1. The coating shall be Tough-Coat as manufactured by VAC Systems Industries, Foster 40-10, 40-20, or 40-23 as manufactured by Foster Products Corporation, or approved equal. Coating shall meet NFPA Standard 90A and 90B and contain an anti-microbial agent.

B. Non-Porous Surface:

1. The paint shall be Porta-Sept as manufactured by Porter Paints, Inc., Foster 40-26 as manufactured by Foster Products Corporation or approved equal. Paint shall contain an EPA registered anti-microbial, Intercept, which inhibits the growth of bacteria, mold, mildew and fungi.

3.06 COLOR CODING

A. Pipe coloring shall conform to the following schedule:

| **PIPING SYSTEM** | **SAFETY COLOR** |
|---|---|
| Air, Compressed | YELLOW |
| Domestic Cold Water | GREEN |
| Fire Protection | RED |
| Natural Gas | YELLOW |

END OF SECTION

SECTION 22 05 93
ADJUSTING AND BALANCING

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

1.02 SUBMITTALS

A. Provide information in report form listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.

B. Report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

1.03 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Individual manufacturer requirements and recommendations.

B. Maintain qualified person at project for system operation, trouble shooting and perform mechanical adjustments in conjunction with balancing procedure.

C. Balancing contractor shall be current member of AABC or NEBB.

1.04 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balancing facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.

2. Prior to balancing adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

## PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required. Instruments used shall be accurately calibrated as per AABC or NEBB requirements.

## PART 3 - EXECUTION

3.01 PREPARATION

A. Examine Bid Documents and notify Owner's Representative of any questions regarding balancing, within thirty (30) days after receipt of bid and prior to starting work.

3.02 WATER SIDE

A. Test, adjust and record the following:

1. Hot Water Recirculating Pump:
   - a. Check rotation
   - b. GPM
   - c. Running suction pressure
   - d. Running discharge pressure
   - e. Running load amps
   - f. RPM - motor
   - g. Complete nameplate motor and pump
2. Recirculation Balancing Valves:
   - a. Balance every valve to 0.5 GPM, unless otherwise noted.

END OF SECTION

SECTION 22 07 00
INSULATION

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTAL

A. Shall include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.
2. Insulation, including jackets, finishes and adhesives on the exterior surfaces of pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
3. Asbestos or asbestos bearing materials are prohibited.
4. 2020 Energy Conservation Code of New York State**.**
5. All adhesives and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ E4.1 and EQ E4.2.
6. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.
7. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.02 ACCEPTABLE MANUFACTURERS

A. Fiberglass: Knauf, Johns Manville, Owen-Corning, Certainteed

B. Polyisocyanurate: Dow Trymer 2000XP, HyTherm.

C. Calcium Silicate: Industrial Insulation Group (ILG).

D. Flexible Elastomeric: Armacell, K-Flex.

E. Adhesives: Childers Products, Foster.

F. Heat Tracing: Raychem, Thermon.

2.03 PIPE INSULATION (RIGID FIBERGLASS TYPE)

A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F.

C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system shall consist of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures shall be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

E. Field-Applied PVC Fitting Covers with Molded Fiberglass Inserts: Hamfab Products, Division of ICA Inc., UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact PVC materials with rigid molded fiberglass inserts. Closures to be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

F. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.04 PIPE INSULATION (FLEXIBLE TYPE)

A. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Adhesive: As recommended by insulation material manufacturer.

B. Insulation (1 in. thickness and smaller) shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102, "Method of Test for Surface Burning Characteristics of Building Materials".

2.05 FIELD-APPLIED JACKETS

A. Piping:

1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; 25 or less flame spread rating/50 or less smoke developed rating, roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.
2. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003-alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
3. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.

2.06 COATINGS, MASTICS, ADHESIVES AND SEALANTS

A. Vapor Barrier Coatings: Used in conjunction with reinforcing mesh to coat insulation on below ambient services temperatures. Permeance shall be no greater than 0.08 perms at 45 mils dry as tested by ASTM F1249. Foster 30-65 Vapor Fas; Childers CP-34, or approved equal.

B. Lagging Adhesives: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas; Childers CP-50AMV1 Chil Seal, or approved equal.

C. Weather Barrier Mastic: Used outdoors to protect above ambient insulation from weather. Foster 46-50 Weatherite; Childers CP-10 Vi Cryl, or approved equal.

D. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.

E. Elastomeric Insulation Adhesive: Used to bond elastomeric insulation. Foster 85-75; Childers CP-82, or approved equal.

F. Elastomeric Insulation Coating: Water based coating used to protect outside of elastomeric insulation. Foster 30-65, Childers CP-34 or approved equal.

G. Insulation Joint Sealant: Used as a vapor sealant on below ambient piping with polyisocyanurate and cellular glass insulation. Foster 95-50; Childers CP-76, or approved equal.

H. Metal Jacketing Sealant: Used as a sealant on metal jacketing seams to prevent water entry. Foster 95-44; Childers CP-76, or approved equal.

I. Reinforcing Mesh: Used in conjunction with coatings/mastics to reinforce. Foster Mast A Fab; Childers Chil Glass #10, or approved equal.

2.07 HEAT TRACING

A. Output Rating:

1. Outdoor Water Piping: 8 watts/foot.
2. Voltage: 120/1/60.

B. The self-regulating heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation-cross-linked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket per section 427-23 of the NEC.

C. All heating-cable components shall be UL Listed for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be re-enterable for servicing. No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

D. Design Equipment: Raychem XL Trace.

2.08 PIPE SUPPORT INSULATION INSERTS

A. 20 lbs./cu. ft. molded fiberglass, for -120°F to +450°F service temperature, non-combustible, 0.30 thermal conductivity (k), same thickness as pipe insulation.

B. Acceptable Manufacturers: Hamfab "H" Block, or approved equal.

2.09 MATERIALS AND SCHEDULES

A. See Exhibits at the end of this section.

**PART 3 - EXECUTION**

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.

C. All pipe insulation shall be continuous through hangers, sleeves, walls, ceiling, floor, or roof openings, unless not allowed by fire stop system. Refer to Sections 220500, "Basic Plumbing Requirements" and 221010, "Piping Systems and Accessories" for firestop systems.

D. Provide thermal insulation on clean, dry surfaces and after piping and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, drain valves, etc. must be totally encapsulated with Elastomeric insulation.

F. Items such as manholes, handholds, clean-outs, plugged connections, pet cocks, air vents, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personal injury.

H. All pipes shall be individually insulated.

I. If any insulation material becomes wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

J. All exposed surfaces shall be white, unless noted otherwise.

3.02 PIPE INSULATION

A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed.

B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed. Insulation shall be continuous through hangers on all water piping and storm water piping.

C. Hanger Shields: Refer to Section 221010 "Piping Systems and Accessories".

D. Hanger shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.
3. Tape shields to insulation.

E. Joints in section pipe covering made as follows:

1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.
3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating.

F. Fittings, Valves and Flanges:

1. Domestic Hot and Cold Water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation. Vapor seal domestic cold water with two (2) coats of white vapor barrier coating.
2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.

G. Flexible Pipe Insulation:

1. Split longitudinal joint and seal with adhesive.
2. Fittings made from miter-cut pieces properly sealed with adhesive, or elbows may be continuous.
3. Where exposed outdoors, provide with Alumaguard jacketing.

H. For piping exposed to the elements, jacketing shall be aluminum with a factory applied moisture barrier. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2 in. overlap joint. All joints shall be sealed completely along the longitudinal seam and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2 in. wide or a minimum

2 in. overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2 in. and be completely weather sealed. Jacket at elbows and tees shall be mitered, or pre-manufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using specified metal jacketing sealant as recommended by the manufacturer.

I. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

J. Apply either aluminum or PVC jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases. Fittings of aluminum-jacketed piping may be either aluminum or standard PVC fitting covers. Jacketing for piping in existing areas shall match existing jacketing.

K. All exposed piping less than 8'-0" above finished floor in occupied spaces shall be insulated a continuous 30 mil thick white PVC jacketing.

L. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness called for. Piping in wall chases: In addition to the above, pack chase with loose glass fiber insulation.

M. Provide insulation on exposed hot and cold plumbing piping to within 18 in. of fixture or equipment connection.

N. Insulate exposed domestic water and waste piping for plumbing fixtures designated for use by the handicapped.

3.03 INSTALLATION OF HEAT TRACING

A. System must be installed per manufacturer's recommendations.

B. Provide coverage for ALL pipes, valves, fittings, etc. exposed to freezing temperatures.

C. Apply the heating cable linearly on the pipe after piping has been successfully pressure-tested. Secure the heating cable to piping with cable ties or fiberglass tape.

D. Apply "Electric Traced" labels to the outside of the thermal insulation.

E. After installation and before and after installing the thermal insulation, subject heating cable to testing using a 2500 VDC Megger, minimum insulation resistance shall be 20 megohms or greater.

## EXHIBIT "I" - PIPE INSULATION MATERIALS
**(Notes at end of Exhibit "I")**

| SERVICE | INSULATION MATERIAL | THICKNESS | REMARKS |
|---|---|---|---|
| Domestic cold water | Glass fiber | 1-1/2 in. and larger: 1 in.<br>1-1/4 in. and smaller: 1/2 in. | SEE NOTES 1, 2 |
| Domestic hot, tempered and circulation water (105°F - 140°F) | Glass fiber | 1-1/2 in. and larger: 1-1/2 in.<br>1-1/4 in. and smaller: 1 in. | SEE NOTES 1, 2 |
| AC unit drains, overflows and indirect waste piping associated with any HVAC equipment | Flexible | All sizes: 1/2 in. | Not required for exposed PVC drains<br>SEE NOTE 2 |

NOTES FOR EXHIBIT I:

NOTE 1: Exposed insulation subject to damage shall be covered with PVC jacket.

NOTE 2: Flexible allowed in 1/2 in. thickness only.

NOTE 3: When PVC piping is installed for storm, sanitary and vent piping within return air plenums, the piping shall be insulated and enclosed in materials listed and labeled for installation within a plenum.

END OF SECTION

SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Commissioning is a systematic process of verifying that all building systems perform interactively according to the Owner's operational needs, the design documents, manufacturer's recommendations, good engineering and workmanship practices. This is achieved by beginning in the design phase and documenting the Owner's requirements and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation provided for the project is complete, accurate and represents the actual installed equipment.
4. Verify that the Owner's operating personnel are adequately trained.

C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

D. Abbreviations: The following are common abbreviations used in the Specifications. Definitions are found in Article 1.2.

A/E - Architects and Design Engineers

CxA - Commissioning Authority

CC - Controls Representative

CTR - Contractors Technical Representative

Cx - Commissioning

Cx Plan - Commissioning Plan Document

EC - Electrical Representative

FT - Functional Performance Test

GC - General Contractor

MC - Mechanical Representative

PFI - Pre-Functional Inspection

PM - Project Manager (of the Owner)

PC - Plumbing Representative TAB - Test and Balance Contractor

1.02 STANDARD AND CORE COMPLIANCE

A. Commissioning will be accomplished to comply with, and in accordance with the requirements of the following:

1. 2020 Energy Conservation Construction Code of New York State, Section C408 System Commissioning.

1.03 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. Additional specific responsibilities, when required, of the mechanical representative, TAB, controls representative, plumbing representative and those of the electrical representative are described in their particular contract specifications and documents. It is noted that the commissioning responsibilities of the Owner's Project Manager, Architect, HVAC Mechanical and Electrical Designers/Engineers and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services, and those responsibilities are listed here only for clarification of the commissioning process.

B. All Parties:

1. Follow the Commissioning Plan.

2. Attend the commissioning scoping meeting and additional meetings as necessary.

C. Commissioning Authority (CxA):

1. The CxA is not responsible for design concept, design criteria, compliance with codes, design or construction scheduling, cost estimating, or construction management. The CxA may assist with problem solving non-conformance or deficiencies, but ultimately that responsibility resides with the GC and A/E. The primary role of the CxA is to develop and coordinate the execution of the Commissioning Plan, observe and document system performance. Specifically, that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractor will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied by the CxA.

2. Construction and Acceptance Phase:

a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular

communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

b. Coordinate the commissioning work and, with the GC and CTRs, verify that commissioning activities are being scheduled into the master schedule.

c. Revise the Commissioning Plan as necessary.

d. Plan and conduct a commissioning scoping meeting.

e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

f. Before startup, gather and review the current control sequences and interlocks and work with installers and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

g. Review equipment submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.

h. Write and distribute prefunctional inspections. The CxA will provide the GC and installers a list of the required submittals. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

i. Develop prefunctional checklists for completion by Contractor.

j. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

k. Witness all or part of the plumbing piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify Owner's Project Manager of any deficiencies in results or procedures.

l. With necessary assistance and review from the Contractor and installers, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.

m. Confirm completion of prefunctional checklists by site observation and spot-checking.

n. Evaluate systems startup procedures by reviewing start-up reports and by selected site observation.

o. Analyze any functional performance trend logs and monitoring data to verify performance.

p. Maintain a master deficiency and resolution log and a separate testing record. Provide the GC, PM and installers with written progress reports and test results with recommended actions.

q. Review equipment warranties to verify that the Owner's responsibilities are clearly defined.

r. Oversee and approve the training of the Owner's operating personnel.

s. Compile and maintain a commissioning record and Systems Energy Manual.

t. Review the preparation of O&M manuals.

u. Provide a final commissioning report.

v. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

w. Return to the site at ten (10) months into the twelve (12) month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

x. Identify any warranty phase deficiencies and provide detailed documentation to the Contractor.

D. General Contractor (GC):

1. Construction and Acceptance Phase:

a. Include the cost of supporting commissioning in the contract price.

b. Attend a commissioning scoping meeting and other commissioning team meetings.

c. Furnish a copy of all construction documents, addenda, change orders and submittals and shop drawings related to commissioned equipment to the CxA. The CxA will forward a request to the GC for copies of the submittals that the CxA is required to review concurrently with the Engineer as required by the LEED guidelines. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

d. Provide the requisite readiness notification to the CxA for equipment prefunctional inspections and functional testing utilizing forms provided by the CxA.

e. Participate in pre-functional inspections, startup and functional testing of all equipment, as directed by the CxA.

f. Review the functional performance test procedures submitted by the CxA, prior to testing, and provide comments.

g. Review commissioning progress and deficiency reports.

h. Coordinate the resolution of deficiencies identified by the CxA.

i. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan utilizing forms provided by the CxA.

j. Coordinate and perform the training of Owner personnel. Notify the CxA when training will be taking place.

k. Ensure that all installers execute their commissioning responsibilities according to the Contract Documents and schedule.

l. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

m. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

n. Ensure that installers execute seasonal or deferred functional performance testing, witnessed by the CxA, according to the specifications.

o. Ensure that installers correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

E. Installers (CTRs):

1. Construction and Acceptance Phase:

a. Attend all commissioning scoping meetings and other commissioning team meetings.

b. Provide the requisite readiness notification to the GC for equipment prefunctional inspections and functional testing.

c. Complete prefunctional checklists developed by the CxA.

d. Review the functional performance test procedures submitted by the CxA, prior to testing.

e. Review commissioning progress and deficiency reports.

f. Coordinate the resolution of deficiencies identified by the CxA.

g. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan.

h. Coordinate and perform the training of Owner personnel.

i. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

j. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

k. Ensure that seasonal or deferred functional performance testing, is executed and witnessed by the CxA, according to the specifications.

l. Ensure deficiencies are corrected and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

F. Equipment Suppliers:

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

2. Assist in equipment commissioning with CTRs as per the Contract Documents.

3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.

4. Provide the information requested by the CxA regarding equipment sequences of operation and testing procedures.

5. Review test procedures for equipment installed by factory representatives.

1.04 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

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 plumbing 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. Certificate of readiness certifying that plumbing systems, subsystems, equipment and associated controls are ready for testing.

6. Test and inspection reports and certificates.

7. Corrective action documents.

8. Verification of testing, adjusting and balancing reports.

1.05 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

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 HVAC&R 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. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting and balancing reports.

1.06 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project. The Owner and the CxA reserves the right to amend this list at anytime during the construction and acceptance process.

B. Plumbing:

1. Domestic water heaters
2. Domestic Hot Water Recirculation System
3. Compressed Air system

**PART 2 - PRODUCTS**

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested.

B. Special equipment, tools, instruments, (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CxA.

C. Datalogging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

## PART 3 - EXECUTION

3.01 MEETINGS

A. Scoping Meeting: The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Commissioning Plan to its final version, which will also be distributed to all parties.

B. Prefunctional Inspection (PFI) Meeting: The CxA will schedule, plan and conduct a PFI meeting with the entire commissioning team in attendance to kickoff the PFI phase.

C. Functional Performance Testing Meeting: The CxA will schedule, plan and conduct a functional performance test meeting with the entire commissioning team in attendance to kickoff the FT phase. The Controls Representative (CC) will play a critical role in the Functional Performance Testing. The CC's Project Manager will be required to attend this meeting.

D. Miscellaneous Meetings: Progress meetings will be scheduled and conducted by the CxA, as necessary. Other meetings will be planned and conducted by the CxA as the construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular CTRs. The CxA will plan these meetings and will minimize unnecessary time being spent by CTRs.

3.02 REPORTING

A. The CxA will provide regular reports to the Owner, PM, GC and A/E depending on the management structure, with increasing frequency as construction and commissioning progresses.

B. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised for commissioning progress, and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report by the CxA will be provided to the Owner. The report will include:

1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a

general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the CxA regarding the adequacy of the equipment, documentation, and training as it relates to the Contract Documents in the following areas:

a. Equipment meeting the equipment specifications.

b. Equipment installation.

c. Functional performance and efficiency.

d. Equipment documentation.

e. Operator training.

2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment and operations, future actions, recommended commissioning process changes, etc. shall also be listed.

3. Also included in the Commissioning Record shall be the issues log, commissioning plan, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests and trend log analysis.

E. The CxA will compile a Systems Manual that consists of the following:

1. Space and use descriptions.

2. Single line drawings and schematics for major systems (to be provided by the Design Engineer).

3. Control drawings and sequences of control (to be provided by the Controls Contractor).

4. Table of all setpoints and implications when changing them.

5. Schedules.

6. Instructions for operation of each piece of equipment for emergencies, seasonal adjustment, startup and shutdown.

7. Instructions for energy savings operations and descriptions of the energy savings strategies in the facility.

8. Recommendation for recommissioning the facility.

9. Energy tracking recommendations.

## 3.03 SUBMITTALS

A. The CxA will provide the Contractor with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At a minimum the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of Owner contracted tests. In addition, the installation and checkout materials that are actually shipped

inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA. All documentation requested by the CxA will be included by the CTRs in their O&M manual contributions.

B. The CxA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CxA will notify the Owner, PM, GC or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission. The CxA does not have approval responsibility, but is required to review the submittals concurrently with the Engineer as required by LEED guidelines.

C. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them.

## 3.04 SYSTEM START-UP AND TESTING

A. General Requirement:

1. All systems and system components shall be tested by the CTRs and in the presence of the Owner and Design Consultants if desired by the Owner and Design Consultants to demonstrate compliance with specified requirements. To minimize the time of commissioning, contracting, and Design Consultant team members, testing shall be done in seasonal single blocks of time insofar as possible.
2. The Contractor shall notify the CxA fourteen (14) days prior to scheduled functional performance tests, of the scheduled completion date of the installation verification and prefunctional inspections.
3. All testing shall be conducted under specified design operating conditions as approved by the CxA and Design Consultants.
4. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on a hierarchical basis. Each piece of equipment shall be tested for proper operation, and functionality of safety devices, followed by each system's subsystem, followed by the entire system, followed by any interlocks to other major systems.
5. All special testing materials and equipment shall be provided by the CTR. This includes, but is not limited to, proprietary equipment, hand-held

control parameter/setpoint adjustment tools, water/air flow balancing readout and adjustment tools.

6. One (1) copy of all factory test reports and records as well as all start-up documentation shall be provided to the CxA.

B. Test Procedure Development and Test Documentation:

1. At least fourteen (14) days prior to startup of the plumbing system, the CTR shall inform the CxA, the Owner's Representative and Design Consultants of the intention to start up the system.

C. Installation Verification Requirements:

1. All systems and system components shall be checked and verified by the CTR that they have been installed according to the drawings, specifications, and manufacturer's written instructions, and that all connections have been made correctly. Discrepancies shall be corrected and resolved to the satisfaction of the Engineer and CxA prior to proceeding any further with prefunctional inspections.
2. Each system of interlocked system components shall be observed and verified by the CTR that it is ready to function as specified.
3. Verification of complete and proper installation shall be completed prior to the CxA authorizing functional performance testing.
4. The installation verification shall be documented by the CTR in a written format for each system/piece of equipment as designated by the CxA. Each certificate of readiness shall be dated and initialed by the Contractor and clearly stating any items that are deficient or have not been completed. The protocols for this will be further clarified in the Commissioning Plan.
5. Certify that plumbing systems, subsystems and equipment have been installed and started and are operating according to the Contract Documents.
6. Certify that testing, adjusting and balancing procedures have been completed and that testing, adjusting and balancing reports have been submitted, discrepancies corrected and corrective work approved.
7. Inspect and verify the position of each device and interlock identified on checklists.
8. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
9. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

D. Prefunctional Inspection Requirements:

1. The CxA will provide the inspection forms for each system and equipment.
2. Verification of completion of the prefunctional checklists is the responsibility of the CxA.

3. Prior to the CxA performing the prefunctional inspection, the CTRs shall check the equipment for proper installation, adjustments, and shall calibrate the equipment to verify that it is ready to perform as specified.

4. Verification of complete and proper installation shall be completed prior to performing functional performance tests.

E. Functional Performance Testing Requirements:

1. A functional performance test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of the CxA based on the written test procedure developed by the CxA to demonstrate conformance to the requirements of the Contract Documents.

2. Each functional performance test shall be performed, witnessed and signed off by the CxA. The CxA and the CTRs will perform the functional testing together. Any exceptions to this will be made clear to the Owner as to the reason and justification.

3. The functional performance testing shall be conducted in accordance with prior approved procedures and documented as required.

4. The Contractor shall notify the contracting team, the CxA, and Design Consultants, at least two weeks prior to the date of schedule functional performance tests. The seasonal functional performance test periods shall be scheduled over a single block of days. The schedule of functional performance tests shall be based on the construction completion schedule.

## 3.05 FUNCTIONAL TESTING SUPPORT REQUIREMENTS

A. General Requirements:

1. This section provides brief descriptions of the testing and support the Contractor and installers will be required to provide to perform the functional testing of the equipment for the project.

B. Domestic Hot Water Systems:

1. The installer(s) will be required to demonstrate all safeties, local device operation, any local controls and any integrated 3rd party Building Management System controls INCLUDING ALL RELATED DEVICES AND SEQUENCE OF OPERATIONS.

2. The installer(s) will be required to manually operate all hand valves, and the controls contractor will be required to demonstrate their systems' integrated performance. Any local controls will require the representative who was responsible for the programming and setting up of the equipment to document the set points and demonstrate the performance of their equipment.

C. Pumping Systems:

1. The installer(s) will be required to demonstrate in writing (TAB Report) that the pumps are balanced to achieve the specified design flows,

including motor performance data as specified in the specifications. The Controls Contractor will be required to demonstrate that the pumps can start, stop, modulate speed (if required) and the lead/lag sequence performs as per the sequence of operations. In addition, a representative will be required to manually operate all hand valves.

D. Pipe system cleaning, flushing, hydrostatic tests and chemical treatment requirements are specified in plumbing piping sections. Plumbing Contractor shall prepare a pipe system cleaning, flushing and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested and chemically treated.

## 3.06 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation - The CxA shall witness and document the results of all functional performance tests using the specific forms developed by the CxA for that purpose.

B. Non-Conformance:

1. The CxA will record the results of the PFIs and functional tests utilizing the appropriate documentation. All deficiencies or non-conformance issues shall be noted and reported to the Owner, PM, GC and CTRs.
2. Reports of the deficiencies identified will be provided to the project team by the CxA. Individual forms identifying the deficiencies for each trade will also be provided. These forms are utilized for the contractor to inform the CxA of the action taken to address the deficiency items and these forms must be returned in a timely manner to the CxA.
3. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases, the deficiency and resolution will be documented by the CxA.
4. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or compromising acceptance criteria to satisfy scheduling

or cost issues, unless there is an overriding reason to do so at the request of the Owner.

5. Cost of Retesting:

   a. The cost for the Installer to repeat a prefunctional inspection or functional test, if they are responsible for the deficiency, shall be theirs.

   b. The time for the CxA to direct any retesting required because a specific prefunctional inspection of start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the appropriate CTR.

6. The Contractor shall respond in writing to the CxA at least as often as commissioning meetings are scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

C. Failure Due to Manufacturer Defect or Improper Installation - If 10%, or three (3), whichever is greater, of identical pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract Documents (either mechanically or substantively) due to manufacturing defect or improper installation, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CxA, PM, A/E or Owner. In such case, the Contractor shall provide the Owner with the following:

1. Within one (1) week of notification from the A/E (via the CxA), the installer or Manufacturer's Representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CxA or PM within two (2) weeks of the original notice.

2. Within two (2) weeks of the original notification, the installer or manufacturer shall provide a signed and dated written explanation of the problem, cause of failures, etc., and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

3. The CxA, G/C and PM will determine whether a replacement of all identical units or a repair is acceptable.

4. Two (2) examples of the proposed solution will be installed by the Contractor and the CxA will be allowed to test the installations for up to one (1) week, upon which the CxA or PM will decide whether to accept the solution.

5. Upon acceptance, the installer and/or manufacturer shall replace or repair all identical items, at their expense, and extend warranty accordingly, if the original equipment warranty had begun. The replacement/repair work

shall proceed with reasonable speed beginning within one (1) week from when parts can be obtained.

D. Approval: The CxA documents each satisfactorily demonstrated functional test.

3.07 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:

1. The specific content and format requirements for the standard O&M manuals are detailed in the contract documents. Special requirements for the controls representative and TAB are detailed in the contract documents.

2. Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the specifications. The CxA will communicate deficiencies in the manuals to the CTRs, PM, GC, A/E or Owner as requested. Upon successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the PM, GC, A/E and Owner. The CxA also reviews each commissioned equipment's warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E contract.

3.08 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and for ultimately ensuring that training is completed. The GC shall inform the CxA when training will be scheduled.

B. The CxA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel for commissioned equipment.

C. The CxA shall interview the facility manager and lead engineer to determine the special needs and areas where training would be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned equipment.

D. In addition to these general requirements, the specific training requirements of Owner's personnel by CTRs, as detailed in the specifications, shall be provided.

E. Each CTR and vendor responsible for training will submit a written training plan to the CxA, for review and approval prior to training. The plan will cover the following elements:

1. Equipment (included in training).
2. Intended audience.
3. Location of training.
4. Objectives.

5. Subjects covered (description, duration of discussion, special methods, etc.).
6. Duration of training on each subject.
7. Instructor for each subject and qualifications.
8. Methods (classroom lecture, video, site walk thru, actual demonstrations, etc.).

F. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training.

3.09 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any inspection or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of inspections and functional testing may be delayed upon approval of the PM or Owner. These tests will be conducted in the same manner as the seasonal test as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate CTRs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.10 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, and, who receives and approves them and the location of the specification to create them. In summary the written products are:

| | **Product** | **Developed By** |
|---|---|---|
| 1. | Final Commissioning Plan | CxA |
| 2. | Commissioning Schedules | CxA, GC and CTRs |
| 3. | Equipment Documentation Submittals | CTRs |
| 4. | Sequence Clarifications | A/E and CTRs as needed |
| 5. | Pre-Functional Inspection Forms | CxA |
| 6. | Pre-Functional Inspections | CxA |
| 7. | Startup and Initial Checkout Plans | CTRs |

| | Product | Developed By |
|---|---|---|
| 8. | Final TAB Report | TAB CTR |
| 9. | Commissioning Progress Record | CxA |
| 10. | Issue and Resolution Log | CxA |
| 11. | Functional Test Procedures | CxA |
| 12. | O&M Manuals | CTRs |
| 13. | Commissioning Record | CxA |
| 14. | Overall Training Plans | GC and CTRs |
| 15. | Specific Training Syllabus | CxA |
| 16. | Final Commissioning Report | CxA |

END OF SECTION

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SECTION 22 10 10
PIPING SYSTEMS AND ACCESSORIES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All items here-in used to convey water for potable use shall be lead free in accordance with NSF, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

2.02 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

a. Couplings: Ductile iron, ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish were called for.

b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.

c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.

d. Fittings: Elbows, tees, laterals, reducers, adapters as required. Same construction as couplings.

e. Design Equipment: Victaulic, rigid system, Style 07 couplings.

f. Acceptable Manufacturers: Grinnell, Gruvlok, Victaulic.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

| Elbow Size | Support Size | Base Plate |
|---|---|---|
| Up to 3 in. | 1-1/4 in. | 6 in. x 6 in. x 1/4 in. |
| 4 in. to 6 in. | 2-1/2 in. | 8 in. x 8 in. x 1/4 in. |
| 8 in. and larger | 6 in. | 14 in. x 14 in. x 5/16 in. |

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.03 STEEL PIPING AND FITTINGS - PRESS CONNECT FITTINGS

A. Piping Standard: Black steel piping shall conform to ASTM A53 or ASTM A106 seamless, Schedule 40 weight pipe.

B. Fittings: Listed in accordance with ANSI LC4/CSA 6.32.

1. For natural gas service, -40 deg. F to 180 deg F at 125 PSI.
2. Sizes 1/2 inch through 4 inch, Schedule 40.
3. Schedule 40 steel fittings with zinc/nickel coating for use with IPS schedule 40 carbon steel, pipe conforming to ASTM A53 or ASTM A106. Fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring and "Smart Connect" (SC) feature.

C. Design Make: Viega Mega Press G System.

D. Acceptable Manufacturer: Viega.

2.04 COPPER TUBE AND FITTINGS

A. Pipe: ASTM B88; Type K or L, hard temper. Soft temper only as called for. Plans show copper tube sizes.

B. Fittings: Wrought copper and copper alloy, ASME B16.22 or cast copper alloy, ASME B16.18; solder end connections.

C. Joints: Comply with the requirements of ASTM B828.

D. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

E. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

F. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.

G. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.05 COPPER TUBE AND FITTINGS - PRESS FITTINGS

A. Tubing Standard: Copper tubing shall conform to ASTM B75 or ASTM B88.

B. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22, or ASME B16.26.

C. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

D. Acceptable Manufacturers: Apollo, Mueller, Nibco, Viega.

2.06 BRASS PIPE AND FITTINGS

A. Piping: ASTM B43, semi-annealed, red brass containing not less than 85% copper; chrome plated where called for.

B. Fittings: Cast brass, sps, malleable iron pattern, reinforced corresponding to weight of pipe; chrome plated with high polished finish where called for.

2.07 HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A74 service weight cast iron, bitumen coated.

B. Fittings: Cast iron, service weight, hub and spigot, drainage pattern, bitumen coated.

C. Connections: ASTM C564 neoprene gaskets and lubricant.

D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.08 NO-HUB CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A888, CISPI Standard 301, no-hub cast iron, bitumen coated.

1. For above grade only.

B. Fittings: Cast iron, no-hub drainage pattern, bitumen coated.

C. Couplings:

1. 1-1/2 in. to 2 in.: CISPI standard 310 with 300 series stainless steel corrugated shield and clamp assembly with ASTM C564 neoprene sealing sleeve (or) same as specified for 3 in. and larger.

2. 3 in. and Larger: 24 gauge, Type 304 stainless steel housing clamp assembly with ASTM C564 neoprene sealing sleeve, 60 in. lbs. minimum torque rating, shall meet requirements of pipe manufacturer and shall be compatible with specified pipe. Acceptable Manufacturers: Clamp-All Coupling System, Tyler "Wide Body", Husky "Series 2000", Mission "Heavy Weight" or approved equal.

D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.09 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.

B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.10 SPECIAL FITTINGS

A. Cast Iron to Lead Pipe: Red brass ferrules and wiped joints. Caulk ferrule into cast iron hub.

B. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.

C. Copper to Steel Piping:

1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.
2. Dielectric pipefittings.

D. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

E. No-Hub, Cast Iron, Glass, Polypropylene or High Silicon Cast Iron: Proper adapter to piping being connected.

F. Cast Iron and PVC Solvent: Aerators and deaerators as manufactured by Conine Manufacturing Co., Inc.

2.11 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Watts or approved equal.

2.12 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.
2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
3. Adjustable steel clevis type for piping 4 in. and larger.
4. Nuts, washers and rods with electroplated zinc or cadmium finish.
5. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.

C. Spacing Schedule:

| Pipe Size | Steel | Copper | Plastic | Cast Iron | Rod Size |
|---|---|---|---|---|---|
| 3/4 in. to 1 in. | 8 ft. | 6 ft. | 3 ft. | Each | 3/8 in. |
| 1-1/4 in. to 2 in. | 10 ft. | 6 ft. | 3 ft. | Horizontal | 3/8 in. |
| 2-1/2 in. to 4 in. | 12 ft. | 10 ft. | 4 ft. | Joint 5 ft. | 1/2 in. |
| 5 in. and over | 12 ft. | 10 ft. | 4 ft. | Maximum | 5/8 in. |
| 8 in. | 12 ft. | 10 ft. | 4 ft. | O.C. | 3/4 in. |
| Over 8 in. | To suit loading conditions. | | | | |

D. Cast Iron No-Hub Supports:

1. In accordance with manufacturer's recommendations.
2. Vertical piping supported at each stack base, at each floor and 15 ft. on center, maximum. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment. Bases of stacks shall be supported on concrete, brick laid in cement mortar, metal brackets attached to the building construction or by other methods approved by the Owner's Representative.
3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with

provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.

E. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.
2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

F. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flat flush plate welded to top of rod or provide additional "Drill-In" inserts and hangers to reduce load per hanger below 1000 lbs.
4. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
5. For Wood Construction: Provide hangers and supports designed for attachment to wood construction.
6. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

H. Trapeze Hangers:

1. For plumbing systems only.
2. Hangers shall be supported with rod sized with a safety factor of four.
3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.
4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.

5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.

I. Hanger Insulation Shields:

1. Hanger insulation shields shall be provided for all water and storm water piping. Hangers shall attach directly to pipe for all remaining services.

2. Piping 2 in. and Smaller: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation.

3. Piping 3 in. and Larger: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield and pipe support insulation insert(s) between pipe and hanger. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation. Provide temporary blocking to maintain proper spacing for insulation.

J. Piping systems with material not listed above shall be supported and protected in accordance with manufacturer's recommendations.

## 2.13 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.

B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.

C. Hubless cast iron fitting restraints shall be Holdrite Series #117 or approved equal.

## 2.14 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.15 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.16 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.17 STACK SLEEVE

A. Cast iron body with caulking recess, flashing clamp and under deck clamp.

B. Acceptable Manufacturers: Jay R. Smith Series 1720, Zurn, Wade.

2.18 STRAINERS

A. Description: Y-Pattern, self-cleaning, except where otherwise indicated, full size of connecting piping, Type 304 stainless steel screens, 125 lb. SWP, unless otherwise indicated.

B. Copper Piping 2-1/2 in. and Smaller: Lead free, cast bronze body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #LF777S.

C. Steel Piping 2-1/2 in. and Smaller: Iron body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #77S

D. Piping 3 in. and Larger, Cold Water Applications: Lead free, cast iron body, flanged ends, standard screen openings, FDA approved epoxy coating, tapped retainer cap and gasket with closure plug; Watts #77F-DI-FDA-125.

2.19 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.

B. See Exhibit "B", "Testing" at end of this Section.

## PART 3 - EXECUTION

3.01 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.02 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.03 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where

insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger that 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.

B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.04 PIPE CONNECTIONS

A. No-Lead Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Copper Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

C. Steel Press Connections:

1. Natural Gas Systems: Sealing elements shall be verified for the intended use. Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and all paint, lacquer, grease, oil, and dirt shall be removed from the pipe end with an abrasive cloth, or with a Ridgid MegaPress pipe end prep tool. Visually examine each fitting sealing element to ensure there is no damage. Insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint. Steel Press fittings shall be installed using Ridgid, MegaPress Tools. Steel Press fittings shall be installed according to the most current edition of the manufacturer's installation guidelines. Installers shall be trained by a manufacturer representative on proper installation procedures.

2. Testing: After Steel Press fittings have been installed a “two step test” shall be followed. Utilizing air or, dry nitrogen, pressurize the system between 5 psi and 45 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, inspect entire system and check for un-pressed fittings. Should un-pressed fittings be identified, ensure the pipe is fully inserted into the fitting and properly marked prior to pressing the joint. After appropriate repairs have been made, test the system per local code, or specification requirements, not to exceed 200 psig.

D. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.

E. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

F. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Dielectric Pipe Fittings: Provide dielectric unions at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined.

H. Grooved Mechanical Joints: Pipe to be prepared in accordance with the latest manufacturer's grooving specification. Use manufacturer's recommended grooving tools. Pipe shall be checked to be sure it is free of indentations, projections; weld seams or roll marks on the exterior of the pipe over the entire gasket seating area. Pipe ends are to be square cut. Lubricant shall be applied to gasket and/or pipe ends and housing interiors to eliminate pinching the gasket.

I. Solvent-Cement Plastic Piping 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. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846.
3. PVC Piping: Join according to ASTM D 2855.

3.05 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.06 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.

B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.

C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.

D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.

E. Fill abandoned sleeves with concrete.

F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.07 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior Locations: Firmly pack with fiberglass and caulk.
2. Exterior Walls and Below Grade Cored Holes: Use sealing element.
3. Cored Holes: Use sealing element.
4. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
5. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

3.08 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.09 TESTS

A. Refer to Exhibit "B" at the end of this section for testing of Plumbing Systems.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

C. Domestic Water:

1. Do not cover joints with insulation until required tests are completed and the Owner's Representative accepts the system.
2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
3. Air test not acceptable as final test.

4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

D. Sanitary:

1. There shall be no loss of water when testing interior piping.
2. Air test not acceptable as final test.
3. Should any leaks, defective joints or defective construction be detected in sewers and/or floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.
4. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

3.10 DOMESTIC WATER PIPING CLEANING AND DISINFECTION

A. Cleaning and disinfecting shall be in accordance with requirements of New York State Department of Health and authority having jurisdiction. Prior to disinfecting, flush piping to remove any sediment and debris.

B. Clean and disinfect water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired.

C. After disinfection procedures, submit water samples in sterile bottles to an approved Department of Health Laboratory. Samples shall be proven equal to the water quality served to the public from the existing water supply system and acceptable to the Department of Health. Flush and disinfect all sections of pipe that fail the laboratory tests. Submit test results indicating water is potable.

3.11 CONNECTIONS TO SPECIAL EQUIPMENT

A. Industrial Equipment:

1. Industrial Equipment shall be furnished by others and set in place by this contractor.
2. Provide all piping, stops, valves, traps and fittings unless otherwise noted on the drawings.
3. Pipe relief valves to floor. Size and arrangement of pipe, traps, valves and fittings, as recommended by manufacturer of equipment.

3.12 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

**EXHIBIT "A" - PIPING MATERIALS (PLUMBING)**
**(Notes at end of Exhibit "A")**

| SERVICE | PIPE MATERIALS | FITTINGS | CONNECTIONS |
|---|---|---|---|
| Combined Water and Fire service | SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020 | | |
| Domestic water interior/hot, cold and circulating 3 in. and smaller | Type L copper | Wrought or cast copper | No-lead solder |
| | Type L copper | Wrought or cast copper | Press fit |
| Domestic water interior/hot, cold and circulating 4 in. and larger | Schedule 40 galvanized steel | Galvanized ductile iron | Roll grooved mechanical type couplings<br>(SEE NOTE 1) |
| | Schedule 40 galvanized steel | Galvanized cast or malleable iron | Flanged |
| | Type L copper | Wrought copper | Brazed |
| | Type L copper | Wrought or cast copper | Roll grooved mechanical type couplings |
| Sanitary, sanitary vent, (buried) | SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020 | | |
| Sanitary, sanitary vent and grease waste | Service weight cast iron soil pipe | Cast iron hub and spigot | Neoprene compression type gasket |
| | Service weight cast iron soil pipe | No hub | No hub neoprene gasket and stainless steel clamp assembly |
| | Type DWV copper | Wrought copper | No-lead solder<br>(SEE NOTE 4) |
| | Schedule 40 PVC, solid wall | PVC, socket type | Solvent cement<br>(SEE NOTE 3) |

| SERVICE | PIPE MATERIALS | FITTINGS | CONNECTIONS |
|---|---|---|---|
| | Service weight cast iron soil pipe | No hub | No hub neoprene gasket and stainless steel clamp assembly |
| Water heater intake piping | Schedule 40 PVC, solid wall | PVC, socket type | Solvent cement<br>(SEE NOTE 3) |
| Water heater exhaust piping | Schedule 40 CPVC, AL-29-4C, Polypropylenel | Stainless steel, CPVC socket type, or Polypropylene to match pipe material | Sealed closure system (SEE NOTE 3) |
| Pump discharge | Schedule 40 galvanized steel | Galvanized cast iron drainage | Threaded |
| | Type L Copper | Wrought copper | No-lead solder |
| Natural gas (buried) | SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020 | | |
| Natural gas (exterior above grade) | Schedule 40, black steel | Butt welded steel | Welded<br>(SEE NOTE 2) |
| | Schedule 40, black steel | Malleable iron, 2 in. and smaller | Threaded<br>(SEE NOTE 2) |
| | Schedule 40, black steel | Steel with zinc/nickel coating | Press fit |
| Natural gas (interior) | Schedule 40, black steel | Malleable iron, 2 in. and smaller | Threaded<br>(SEE NOTE 2) |
| | Schedule 40, black steel | Butt welded steel, 2-1/2 in. and larger | Welded<br>(SEE NOTE 2) |
| Compressed air (shop and industrial) | Schedule 40, black steel | Malleable iron, 3 in. and smaller | Threaded |
| | Schedule 40, black steel | Butt welded steel, 4 in. and larger | Welded |

NOTES FOR EXHIBIT A:

NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code and the local Water Bureau Requirements. Pipe and fittings shall be flanged.

NOTE 2: Provide one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel on exposed exterior and interior piping. Color as selected.

NOTE 3: (Not Used). NOTE 4: PVC piping shall not be installed within return air plenums.

NOTE 4: Copper piping shall not be used for urinal waste piping.

NOTE 5: CPVC piping, copper tube size (SDR11) permitted for piping 2 in. and smaller. CPVC piping, Schedule 80 permitted for piping 3 in. and larger.

NOTE 6: All uninsulated piping supported by trapeze hangers shall be securely fastened to each hanger using strut-mounted cushion clamps.

## EXHIBIT "B" - TESTING

| SERVICE | TEST REQUIREMENTS |
|---|---|
| Domestic water | Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI |
| Sanitary, sanitary vent, storm | Maintain 10 ft. head of water for two (2) hours. |
| Indirect waste | Maintain 10 ft. head of water for two (2) hours. |
| Acid waste and vent | Maintain 10 ft. head of water for two (2) hours. |
| Swimming pool piping | Refer to Section 225100 - "Pool Equipment". |
| Pump discharge | Hydrostatically test at 5 PSI greater than the pump rating for two (2) hours. |
| Fuel oil piping, supply and return, fill and vent | Refer to Section 227020 - "Fuel Storage Tanks and Accessories". |
| Engine exhaust | Test in accordance with the engineer/generator manufacturer's recommendations. |
| Natural gas | Refer to Section 227010 - "Natural Gas Systems". |
| LP gas (propane) | Refer to Section 227011 - "LP Gas System". |
| Reverse osmosis, deionized water | Test with inert gas (nitrogen) at a pressure of 125 PSI for two (2) hours. |
| Compressed air (house, shop and industrial) | Test with clean air or nitrogen at a pressure of 175 PSI for 24 hours. |
| Compressed air (medical, air intake) | Refer to Section 226100 - "Medical Compressed Air". |
| Vacuum (medical, exhaust piping) | Refer to Section 226200 - "Vacuum System". |
| Oxygen | Refer to Section 226300 - "Oxygen Systems". |
| Nitrous oxide, nitrogen | Test with oil free dry nitrogen at 1.5 times the working pressure (150 PSI min.) Maintain pressure until all joints have been examined. Refer to Section 226300 for applicable information. |

END OF SECTION

SECTION 22 10 20
UNDERGROUND PIPING AND ACCESSORIES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents

1.02 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and fittings new and marked with manufacturer's name, complying with applicable ASTM and ANSI Standards.

2.02 CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A74 service weight cast iron, bitumen coated, hub and spigot.

B. Fittings: Service weight cast iron, bitumen coated, hub and spigot, ASTM C564 service weight neoprene gasket of same manufacturer as piping.

C. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.03 COPPER PIPE AND FITTINGS

A. Pipe: ASTM B88, Type K, Soft Temper

B. Fittings: ANSI B16.22 wrought copper; ANSI B16.26 and ASTM B62 cast bronze; flared end connections.

2.04 DUCTILE IRON PIPE AND FITTINGS

A. Pipe: AWWA C151/ANSI A21.51, Class 52, ductile iron, mechanical type joints for short runs, otherwise use push-on type joints.

B. Fittings: AWWA C110/ANSI A21.51, ductile iron, 250-psi pressure rating (or) AWWA C153/ANSI A21.53 ductile iron compact fitting, 350 psi pressure rating. Joints shall be restrained, mechanical type for short runs, otherwise use push-on type.

C. Lining: Pipe and fittings shall have double thickness cement mortar lining with seal per AWWA C104/ANSI A21.4 on interior and asphaltic coating on outside.

D. Glands and Gaskets: AWWA C111/ANSI A21.11, ductile iron gland, rubber gasket joints, provide two bronze wedges for each joint of pipe.

2.05 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.

B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.06 POLYETHYLENE PIPE AND FITTINGS - NATURAL GAS

A. Pipe: ASTM D2513, SDR 11, PE3408 high-density polyethylene, black with yellow stripe, for conEdison.

B. Fittings: Same material as pipe Heat fusion joints, socket-type ASTM D2683

C. Acceptable Manufacturers: Adrisco, Chevron Phillips, or approved equal.

2.07 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53 or ASTM A106 seamless, Schedule 40 or 80 weight; black or galvanized finish, factory coated.

B. Fittings: Same material and pressure class as adjoining pipe, black or galvanized finish, field coated and wrapped.

1. Welded Fittings: Factory forged, seamless construction, butt weld type, chamfered ends.
2. Threaded Fittings: Malleable iron.

2.08 DETECTABLE TAPE

A. Detectable underground warning tape, 5 mil. polyethylene, 6 in. wide, aluminum backing, APWA approved background colors within permanent black lettering identifying service below.

B. Schedule:

1. Sanitary: Green color, "Caution Buried Sewer Line Below".
2. Storm: Green color, "Caution Buried Sewer Line Below".
3. Water: Blue color, "Caution Buried Water Line Below".
4. Gas: Yellow color, "Caution Buried Gas Line Below".
5. Electric: Red color, "Caution Buried Electric Line Below".

C. Acceptable Manufacturers: Seton, Terra Tape, Pro-Line Safety Products, Inc.

2.09 SCHEDULE OF PIPING MATERIALS

A. See Exhibit "A", Schedule of Piping Materials at end of this section for piping.

**PART 3 - EXECUTION**

3.01 TESTING

A. Sanitary and Storm:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.
2. There shall be no loss of water when testing interior piping inside the building foundation.
3. Air test not acceptable as final test.
4. Should any leaks, defective joints or defective construction be detected in sewers, floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.
5. Test exterior piping outside the building foundation in 100 ft. sections. The allowable rate of leakage per 24 hours per in. of diameter per 1,000 ft. of sewer tested shall not exceed 25 gallons. Piping shall be inspected and tested prior to backfill.
6. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test reports to Owner's Representative.

B. Domestic Water:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.
2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
3. Air test not acceptable as final test.
4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

C. Test exterior water and fire service piping outside the building foundation hydrostatically at 200 psi for two (2) hours. The amount of leakage shall not exceed two (2) quarts per hour per 100 gaskets or joints. Conform to NFPA 24.

3.02 DETECTABLE TAPE

A. Provide detectable tape directly over the buried pipe lines at a depth of 1 ft. - 0 in. below finished grade. Install tape over the continuous length of the pipe.

3.03 GAS PIPING

A. Refer to Section 227010, "Natural Gas Systems".

3.04 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by a certified welder. Use full length pipe where possible; minimum distance between welds, 18 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds shall be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

3.05 CATHODIC PROTECTION

A. Provide all electrical work, wiring fittings, anodes, bonding, thermite brazing and all other work and items required for a complete cathodic protection system.

B. Anodes shall be installed and backfilled in wet native soil, a minimum of 3 ft. from the pipe and below the center line of the pipe. Anode lead wires shall terminate on a test station lug with a lead wire thermite brazed to the pipe.

C. Wiring shall be buried 2 ft. below grade, with 6 in. minimum separation from other underground structures. Wiring shall be backfilled with material free from rocks and debris.

D. Splices and electrical connections shall be made with copper compression bolts and shall be made moisture proof. Electrical connections to the piping shall be made using the thermite weld process.

E. Thermite brazing techniques shall comply with the manufacturer's recommendations. Only proper size cartridges and welders will be permitted. Clean pipe to bright metal 3 sq. in. in area to be brazed. The brazed connection and pipe shall be coated with a cold applied coal tar compound.

F. Test leads shall be #12 AWG solid copper conductors with TW insulation and installed with thermite brazing. Terminate within test station at grade.

G. Electrical Isolation Fittings: Provide electrical isolating fittings at tank connection at building wall penetration.

H. Testing:

1. Testing shall be performed in accordance with accepted practices as recommended by National Association of Corrosion Engineers (NACE).

2. Test insulating fittings for electrical isolation.
3. Measure structure-to-soil potential at representative locations throughout the system.
4. Record anode current outputs at test stations.
5. Adjust the cathodic protection system to comply with the criteria for protection as given in NACE RP-01-69.

## EXHIBIT "A" - PIPING MATERIALS (PLUMBING)

**(Notes are at end of Exhibit "A")**

| SERVICE | PIPE MATERIALS | FITTINGS | CONNECTIONS |
|---|---|---|---|
| Combined Fire/Water service | Ductile iron water main with cement lining | Ductile iron | Mechanical or push-on type (SEE NOTE 3) |
| Sanitary | Service weight cast iron soil pipe | Cast iron, hub and spigot | Neoprene gasket compression type |
| | Schedule 40 PVC, solid wall | PVC, socket type | Solvent cement (SEE NOTE 4) |
| Sanitary vent | Service weight cast iron soil pipe | Cast iron, hub and spigot | Neoprene gasket compression type |
| Ducting Pipe | Polyethylene | | Mechanical (SEE NOTE 2) |
| Natural gas | Schedule 40 steel, factory applied corrosion protective coating | Butt welded steel | Welded (SEE NOTE 1) |
| | SDR 11 Polyethylene | Polyethylene | Heat fusion |

NOTES FOR EXHIBIT A:

NOTE 1: On buried coated steel pipe, tape all joints with Scotchwrap #50, 2 in. wide, 50% overlap. Provide cathodic protection system.

NOTE 2: Fittings and adapters used shall be specifically made for the piping system installed. All underground piping shall be installed within ducting pipe.

NOTE 3: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code and local Water Bureau Requirements. Pipe and fittings shall be flanged.

NOTE 4: Schedule 40 PVC pipe may not be used when the temperature of the waste can exceed 140°F.

## EXHIBIT "B" - TESTING

| SERVICE | TEST REQUIREMENTS |
|---|---|
| Sanitary, sanitary vent, storm | Maintain 10 ft. head of water for two (2) hours. |
| Natural gas | Refer to Section 227010 - "Natural Gas Systems". |
| Combined Fire/water service | Test hydrostatically at 200 PSI or 50 PSI in excess of the system working pressure, whichever is greater for two (2) hours. |

END OF SECTION

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SECTION 22 10 30
PUMPS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards and listings/approvals:

1. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.03 SUBMITTALS

A. Submit manufacturer's data in accordance with the Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this Section.

## PART 2 - PRODUCTS

2.01 HOT WATER CIRCULATING PUMP

A. Pump: Inline centrifugal, all stainless steel, system fluid lubricated, 145 psi working pressure, 230°F water temperature, ceramic shaft and radial rings, flange mount.

B. Motor: Impedance protected, stainless steel can and static o-ring seals to isolate stator from system fluid, non-overloading throughout the pump curve.

C. Electric Control: Demand control and aquastat for each pump and wiring to motor starter. Starter and time clock by Electrical Contractor.

D. Refer to schedule on drawings for capacity and electrical characteristics.

E. Acceptable Manufacturers: Armstrong, Bell and Gossett, Grundfos.

2.02 SUMP PUMP - SUBMERSIBLE

A. Pump: Simplex, submersible type, 2 in. discharge, bronze construction, non clog impeller, stainless steel shaft, capable of handling 5/8 in. solids, mechanical seal, minimum 50 gpm capacity.

B. Motor: Oil filled, permanent lubrication, automatic reset thermal overload, oil and water resistant power cord with plug, non-overloading throughout the pump curve.

C. Electric Control: Built-in automatic diaphragm-type pressure switch, completely prewired, requiring only receptacle for plug in power connection.

D. Basin: Fiberglass, 24 in. diameter, anti-floatation flange, perforated steel cover, with steel curb ring and concrete anchor.

E. Refer to schedule on drawings for capacity and electrical characteristics.

F. Acceptable Manufacturers: Hydromatic, Goulds, Weil, Zoeller.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Pumps shall be installed, aligned and started in accordance with manufacturers written installation instruction.

B. Install pumps in locations to provide access for maintenance and replacement of parts.

C. Support pumps and piping separately so that piping does not support pumps.

D. Provide the services of a factory trained mechanic to start up the system based on factory recommendations. Provide Owner instruction at time of start up. Submit three (3) copies of start up report to the Owner's Representative.

E. All wiring for sump pump(s) between control panel and junction box shall be continuous. No junction boxes allowed within pump basin.

### 3.02 HOT WATER CIRCULATING PUMP

A. Install shutoff valve and strainer on pump suction; check valve, balancing valve and shutoff valve in pump discharge. Install pressure gauge on suction and discharge piping. Adjust gpm of each circulating pump to capacity as noted.

### 3.03 SUMP PUMP

A. Install gate valve and check valve in discharge piping for each pump.

B. Simplex pump operation shall be completely automatic. Pressure style switch shall start and stop the pump at the factory set levels. Float style switches shall be adjusted to start and stop the pump at the specified levels.

C. Install liquid level control devices at proper elevation to produce specified sump drawdown. Secure control devices to discharge piping with corrosion resistant brackets and fasteners.

D. Install high water alarm and make electrical connections. Install liquid level control device at proper liquid depth. Secure control device to discharge piping with corrosion resistant brackets and fasteners.

3.04 TESTING

A. Test hot water recirculating pumps for operation.

B. Test sanitary pumping systems for operation at specified liquid depths.

C. Test high water alarm for operation at specified liquid depth.

D. Certify in writing that tests have been performed and the systems are properly operating. Submit three (3) copies of all test reports to the Owner's Representative.

END OF SECTION

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SECTION 22 11 00
WATER SUPPLY

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards, and listings/approvals:

1. ANSI/AWWA C600: AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
2. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
3. New York State Health Department.
4. Local municipality and fire department requirements and standards.
5. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.03 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this Section.

## PART 2 - PRODUCTS

2.01 WATER PIPING

A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories" and Section 221020, "Underground Piping and Accessories".

2.02 WATER METER

A. Water Service: AWWA Standard C702 compound type. Obtain meter from local Water Authority. Pay all costs.

1. Acceptable Manufacturers: Hersey, Rockwell, Trident, or approved equal.

B. Fire Service: Mainline meter for large flows with full flow waterway and bypass, same size as fire service, FM approved, AWWA Standard C703 cold water meters - fire service type. Shall meet Local Water Authority Standards.

1. Acceptable Manufacturers: Hersey, Trident or approved equal.

## 2.03 BACKFLOW PREVENTERS AND ACCESSORIES

A. Reduced Pressure Type (Domestic Water - 2 in. and Smaller):

1. All bronze body construction, stainless steel bolts and internal parts, stainless steel check seats.
2. Four (4) test cocks, bronze strainer and full port ball valve shutoffs.
3. Design Equipment: Watts Series 909.
4. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

B. Reduced Pressure Type (Domestic Water - 2-1/2 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated, bronze relief valve.
2. Four (4) test cocks, epoxy-coated strainer, OS&Y resilient wedge gate valves.
3. Design Equipment: Watts Series 909.
4. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

C. Double Check Detector Assembly Type (Fire Service - 3 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated.
2. Four (4) test cocks, OS&Y resilient wedge gate valves.
3. UL/FM listed and approved.
4. Same size as fire service.
5. Detector assembly consisting of an approved double check valve backflow preventer, approved water meter and shutoffs.
6. Design Equipment: Watts Series 709 DCDA.
7. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

D. Dual Check Type with Intermediate Atmospheric Vent (Coffee and Ice Machines):

1. Conforms to NSF Standard No. 25, stainless steel body, threaded end connections, rubber diaphragm, ball check, vent extended to drain.
2. Design Equipment: Watts #9BD.
3. Acceptable Manufacturers: Conbraco, Febco, Watts, Zurn.

## 2.04 VACUUM BREAKERS

A. Atmospheric Type:

1. Lead free brass body, silicone disc, ASSE 1001, threaded inlet and outlet connections, polished chrome for finished areas.
2. Design Equipment: Watts Series #LF288-A
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

B. Hose Connection Type:

1. Brass body, stainless steel working parts, rubber diaphragm and disc, drainable, non removable feature, polished chrome for finished areas.
2. Design Equipment: Watts #8A.
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

C. Pressure Type and Spill Resistant Type - Interior use:

1. Lead free bronze body, anti-siphon and spill resistant type, one-piece thermoplastic modular check and float assembly, stainless steel springs, ball valve shutoffs on inlet and outlet, test connection.
2. Design Equipment: Watts #LF008PCQT.
3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

## PART 3 - EXECUTION

### 3.01 GENERAL

A. Coordinate work with all other trades and utility company.

B. Inspect pipe, fittings and equipment prior to installation. Remove all defective materials from the site.

C. Do not backfill until inspection by Owner's Representative.

D. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

### 3.02 WATER SERVICE

A. Install all piping on firm bed, using caution where piping passes over excavation. Provide concrete thrust blocks to support hydrant and prevent movement at all changes in direction of piping. Thrust blocks not required for Type K copper piping installation. Provide rods, clamps and retainer glands on all elbows and fittings in accordance with manufacturer's recommendations to prevent fitting from blowing off under line pressure. Coat all clamps, rods, nuts with two coats of bitumastic.

B. Minimum earth cover shall be 5 ft. - 0 in. unless otherwise noted.

C. Water mains crossing sanitary or storm sewers shall be installed to provide a minimum vertical distance of 1 ft. - 6 inches between the outside of the pipes where the water main is above or below the sewer. Locate the water pipe so that the crossing of the sewer occurs at the mid-section of a full length of pipe. The minimum horizontal separation between water mains and sewer mains shall be 10 ft. - 0 in. measured from the outside of the pipes. If separation or distance of joints from pipe crossing cannot be established, encase water piping in 6 in. concrete for a distance 10 ft. - 0 in. each side of crossing.

3.03 WATER METER

A. Provide pressure gauge on outlet side of meter. Provide line size strainer on inlet side of meter. Provide concrete base or pipe stands to support meter assembly. Provide bypass piping with sealed valve around meter.

B. The water meter assembly and piping arrangement shall be installed in accordance with the local Water Authority Standards.

3.04 BACKFLOW PREVENTERS

A. The backflow preventer installation shall be installed in accordance to the Health Department approved drawings.

B. Provide hub style drain for emergency relief drain with a pipe separation of at least two (2) pipe diameters from backflow preventer relief outlet.

3.05 PIPING

A. Run slightly off level to low points; provide drain valves at low points. Provide shock absorbers where shown, or specified. Branch headers serving flush valves shall be full size as shown. Exposed water piping in Kitchen shall be chrome plated brass (from insulation to fixture or equipment connection.). Provide dielectric pipe fittings when connecting to piping systems of dissimilar metals. All supply piping to fixtures, faucets, hydrants and flush valves shall be anchored to prevent movement.

B. Provide shock absorbers where flush valves and quick closing valves are used as specified in Section 223010.

3.06 ARRANGEMENTS

A. Provide for application to and obtain approval from the local Water Authority for connection to municipal systems.

B. Contact the Water Authority for the extent of their work, the costs, fees, required permits and their installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the base bid.

3.07 CLEANING AND DISINFECTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for domestic water piping cleaning and disinfecting requirements.

3.08 TESTS

A. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner.

B. Upon completion of construction, all backflow prevention devices provided under this contract shall be tested. Tests shall be performed by a certified backflow preventer tester registered by the New York State Department of Health. Provide three (3) copies of Form DOH-1013 for each device with Part A completed by the tester. Submit forms to Engineer. Pay all costs required for testing devices, including administrative costs associated with satisfying the requirements and regulations of Water Authority and Health Department. Repair or replace any device failing the test and repeat the test.

C. Test each vacuum breaker according to authorities having jurisdiction and the device's reference standard.

D. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION

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SECTION 22 13 00
SANITARY, WASTE AND STORM DRAINAGE SYSTEMS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

## PART 2 - PRODUCTS

2.01 PLUMBING DRAINAGE SYSTEM

A. Piping Materials: Refer to Section 221010, "Piping Systems and Accessories" and 221020, "Underground Piping and Accessories" for piping materials.

2.02 HYDROFLUSHING

A. The hydroflushing equipment used for sewer cleaning shall be designed and constructed for sewer cleaning and be capable of removing sludge, grease, dirt and other foreign materials. It shall consist of, but not be limited to, booster pump, high pressure hose, water spray jet, cutting nozzles and all accessories required to complete the work.

2.03 TELEVISION INSPECTION

A. The television camera used for inspection shall be designed and constructed for sewer inspection and shall be sufficient to allow a clear, visible picture. It shall consist of, but not be limited to, camera, TV monitor, videotape equipment and all accessories required to complete the work.

## PART 3 - EXECUTION

3.01 GENERAL

A. Prior to commencing work, the Contractor shall verify inverts and locations. Any discrepancy between plans and field conditions shall be reported to the Owner or Engineer. No work shall start until discrepancies have been resolved. All costs related to Contractor's failure to verify and report discrepancies will be borne by the Contractor.

B. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.02 PIPE INSTALLATION

A. Minimum Pitch: 2-1/2 in. and under - 1/4 in. per ft.; 3 in. to 6 in. - 1/8 in. per ft; 8 in. and larger - 1/16 in. per ft.

B. All underground sanitary piping shall be a minimum of 3 inch size.

C. Urinal Waste: Copper is <u>not</u> allowed.

D. In all finished spaces, paint exposed waste piping 2 in. and over with chromium paint.

E. Slope piping as indicated on drawing; verify inverts given. Inspect piping before installation to detect apparent defects. Remove defective piping from site. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Install piping and gaskets in accordance with manufacturer's recommendations and other special installation requirements. Clean interior of piping of dirt and other foreign material as work progresses. Place plugs in ends of pipe at end of day or whenever work stops. Flush lines if required to remove collected debris.

F. Inspect piping to determine whether line displacement or other damage has occurred. Make inspections after lines have been installed and approximately 2 ft. of backfill is in place, and again at completion of project. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.

3.03 ARRANGEMENTS

A. Make arrangements and obtain approval of the local Sewer Department to connect to the municipal system.

B. Contact the local Sewer Department for the extent of their work, the costs, fees, required permits and installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the Base Bid.

3.04 HYDROFLUSHING

A. Upon completion of the project, mechanically auger and hydroflush clean all new buried sanitary, waste and storm drainage piping 4 in. and larger. Use cutting nozzles when applicable. Do not mechanically auger or use cutting nozzles when piping is clay tile or plastic piping.

B. Hydroflush piping utilizing full length of jet hose. Thoroughly flush all piping for 30 minutes upon completion of hydroflushing. Piping shall be clean.

C. Field check existing piping layout prior to commencement of cleaning operations. Take all precautions to prevent water leaks within the buildings.

D. Determine the existing sewer materials prior to cleaning. Should pipe be any material other than cast iron, do not proceed. Notify Owner's Representative.

E. All hydroflushing of drain lines shall be performed against the direction of flow of the waste water, unless otherwise noted.

F. Restore all areas disturbed to match existing.

G. The cleaning and flushing services shall be performed by one approved service firm.

3.05 TELEVISION INSPECTION

A. After completion of hydroflushing, furnish all labor, materials and equipment necessary to provide television inspection of all hydroflushed piping.

B. Provide a digital video copy accompanied with a written report and drawings locating all sources of infiltration, blockages and obstructions, broken pipe, collapsed pipe, misalignments, pipe sags and unusual conditions observed. The digital video copy and report shall be cross-referenced. Provide a copy of each to the Owner's Representative.

3.06 TESTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION

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# SECTION 22 13 19.23

# OIL WATER SEPARATOR

## PART 1 - GENERAL

1.1 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install the oil water separator and appurtenances in accordance with the Drawings and these specifications.

1.2 RELATED WORK:

A. Section 31 00 00, EARTHWORK

1.3 QUALITY CONTROL INSPECTION:

A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer’s acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

B. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.

C. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi when tested in accordance with ASTM C-109. Epoxy mortar may be utilized for repairs.

1.4 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop Drawings

1. Structural design calculations and shop drawings shall be certified by a Professional Engineer retained by the unit manufacturer or Contractor and licensed in the state where the system is to be installed. Six (6) copies of said shop drawings shall be submitted to the Engineer for review and approval.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND DESIGN:

A. Concrete for the precast oil water separator shall conform to ASTM C 857 and C 858.

B. Brick or masonry used to build the manhole frame to grade shall conform to ASTM C 32 or ASTM C 139 and shall be installed in conformance with all local requirements.

C. Casting for manhole frames and covers shall be in accordance with ASTM A48, CLASS 30B and AASHTO M105.

D. A bitumen sealant in conformance with ASTM C 990 shall be utilized in affixing the aluminum swirl chamber to the concrete vault.

### 2.2 MANUFACTURER:

A. The oil water separator shall be Arrow Concrete product designed for a design load of HS-20, or approved equal and shall have a capacity (gallons) as shown on drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

A. The oil water separator shall be constructed according to the sizes shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise required by the Engineer.

B. Place the base of the unit on a granular subbase of minimum thickness of six inches after compaction or of greater thickness and compaction if specified elsewhere. The granular subbase shall be checked for level prior to setting and the precast base section of the trap shall be checked for level at all four corners after it is set. If the slope from any corner to any other corner exceeds 0.5% the base section shall be removed and the granular subbase material re-leveled.

C. After setting the precast roof section of the oil water separator, set precast concrete manhole riser sections, to the height required to bring the cast iron manhole covers to grade, so that the sections are vertical and in true alignment with a ¼-inch maximum

tolerance allowed. Backfill in a careful manner, bringing the fill up in 6-inch lifts on all sides. If leaks appear, clean the inside joints and caulk with lead wool to the satisfaction of the Engineer. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the oil water separator shall conform to ASTM specification C 891 "Standard Practice for Installation of Underground Precast Utility Structures".

D. Holes made in the concrete sections for handling or other purposes shall be plugged with a non-shrink grout or by using grout in combination with concrete plugs.

E. Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints. The Contractor shall make all pipe connections.

END OF SECTION 22 13 19.23

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SECTION 22 30 10
EQUIPMENT

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.02 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

## PART 2 - PRODUCTS

2.01 FLOOR DRAINS

A. Drain Description: All Floor Drains Type A unless otherwise noted.

1. Type A: Cast iron body, flashing collar with weepholes, nickel bronze, 7 in. diameter adjustable strainer; Jay R. Smith Figure #2010-A.
2. Type B: Cast iron body, flashing collar with weepholes, nickel bronze 7 in. diameter adjustable strainer with recessed anti-flood rim; Jay R. Smith Figure #2010 with #F37 rim.
3. Type C: Cast iron body, flashing collar with weepholes, 12 in. diameter grate, heavy duty, deep body, removable sediment bucket; Jay R. Smith Figure #2243C.

B. Where floor drains are not installed in slabs on grade, provide flashing collar and flash with 24 in. square four (4) pound lead flashing or equal.

C. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.02 CLEANOUTS

A. Floors: Cast iron body, nickel-bronze top with adjustable feature, bronze plug and flashing clamp where required, carpet marker and tile cover where applicable; Jay R. Smith Series #4028.

B. Walls: Cast iron ferrule, with bronze plug and stainless steel smooth access cover.

1. Horizontal: Jay R. Smith Figure #4402.
2. Vertical: Jay R. Smith Figure #4531.

C. Yard Cleanout:

1. Cast iron body, adjustable round heavy duty top, with tractor cover, vandal proof screws and bronze plug; Jay R. Smith Figure #4246.

D. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.03 WALL HYDRANTS

A. Exposed type hose connection, lead-free, solder connection, nickel bronze face, quarter turn valve, nonfreeze type, 3/4 in. hose connection, self draining, integral vacuum breaker with vandal resistant cap, loose key control and wall clamp; Jay R. Smith Figure #5609QT.

B. Make: Jay R. Smith, Prier, Watts, Woodford or Zurn.

2.04 HOSE BIBBS (INTERIOR)

A. Inside sill faucet, vacuum breaker, lead-free, solder connection, 3/4 in. hose thread outlet, lock shield cap, loose key control, flanged female inlet, polished chrome plate finish for finished rooms, rough chromium for unfinished rooms.

B. Make: Woodford Model 84, Prier, Chicago Faucets or Acorn in finished room; Chicago Faucets #998 in Mechanical Rooms, Boiler Room, Penthouse, or other unfinished rooms.

2.05 SHOCK ABSORBERS

A. Hydropneumatically controlled with permanently sealed expansion chamber pre-charged with non-combustible gas; lead-free, threaded connection, meets or exceeds Plumbing and Drainage Institute Standard PDI WH-201 and ASSE Standard 1010.

1. Bellows Type: Stainless steel construction with stainless steel bellows.

2. Piston Type: Hard drawn copper body with brass piston, cap and adapter, and elastomer seals.

B. Elastomer or rubber compound type bellows not allowed.

C. Make: Watts #LF15M2, Precision Plumbing Products, Jay R. Smith, or Zurn.

2.06 TRAP GUARDS

A. Elastomeric, normally closed seal to prevent evaporation of P-traps. Inserts into throat of floor drain. Provide for each new floor drain.

B. Make: ProVent Systems, Inc. "ProSet Trap Guard".

2.07 WATER PRESSURE GAUGES

A. Construction to be Bourdon tube type; 4-1/2 in. diameter, minimum dial face, in cast aluminum case, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip, 1/4 in. bottom connection. Accuracy, on (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber and needle valve.

B. Make: Trerice, Weiss, Weksler, Winters.

2.08 PIPING SYSTEM THERMOMETERS

A. Industrial type, plastic, aluminum or steel case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks were required; range as called for service. Universal adjustable type, 9 in. scale. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F. For installation greater than 120°F, graduations of 2°F, accurate to within 1°F.

B. Make: Trerice, Weiss, Weksler, Winters.

2.09 TEMPERATURE MIXING VALVE - HIGH/LOW TYPE

A. Valve shall mix 140°F hot water with 40°F cold water to obtain a water outlet temperature of 120°F. The valve shall consist of the following:

1. High/low style, single thermostatic mixing valve with 3/4 in. inlet and 1 in. outlet. Flow capacity of 21 gpm at 5 psi pressure drop, and 43 gpm at 20 psi pressure drop.
2. Combination strainer check stops with union at each inlet, union on outlet, tamper resistant temperature adjustment control.
3. Provide valves on hot, cold and tempered water piping with fittings, nipples, trim piping and escutcheon plates. Horizontal stem dial thermometers on hot, cold and tempered water piping.
4. Rough bronze lead free mixing valve and trim exposed on wall.

B. Make: Powers Series LFSH 1430, Leonard, or Symmons.

2.10 TRENCH DRAIN

A. Extra Heavy Duty 12" wide grate having safe live load between 7,500 lbs and 10,000 lbs, DIN 19580/EN1433 rated grate and top rim Load Classification 'E'.

B. Pre-sloped Trench Drain System. High density polyethylene structural composite drain channel with 1.04% bottom slope. All sections 96 in. modular lengths, heavy-duty galvanized steel frame with anchor studs, integral top frame, interlocking ends and radiused bottom. Combination tie-down/leveling devices at 20 in. intervals. Integral rebar clip.

C. Galvanized Heel-proof ductile slotted grate - Class E

D. High density polyethylene structural composite catch basin with sediment basket. Complete with interlocking ends, combination tie-down/leveling devices and heavy duty galvanized heel-proof ductile grate - Class E. Integral rebar clip. Heavy duty frame, Zurn model Z887-12 or equal.

E. Provide rebar steel stakes for temporary support and leveling during installation. Size per drain manufacturer.

F. Manufacturer: Zurn Z-882-HDG Trench Drain System or equal.

## PART 3 - EXECUTION

### 3.01 EQUIPMENT CONNECTIONS

A. Plumbing Contractor shall:

1. Provide all roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment requiring same as called for on Contract Documents.
2. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
3. Provide loose key stops, "P" traps, tailpieces, adapters, gas or air cocks and all necessary piping and fittings from roughing point to equipment.
4. Provide for installation of sinks, faucets, traps, tailpieces provided by an Equipment Contractor. These items to be delivered, in easily identified cartons, to the proper room for Contractor's installation.
5. Install controls and devices furnished by others.
6. Provide cold water line with gate valve and backflow prevention device at locations called for. Continuation and connection to equipment by others.
7. Install relief valve discharge piping from equipment relief valves.
8. Provide for Owner furnished equipment:
   a. Connect complete and ready for use, including all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, etc., as required by Owner.
   b. Refer to manufacturer Drawings and Specifications for requirements of special equipment. Verify connection requirements before bidding.

### 3.02 CLEANOUTS

A. Install cleanouts out of traffic patterns and flush to floor. Provide offset from sanitary line served. Do not locate under doors or under lockers. Maintain distance between cleanouts on piping 4 in. and smaller, 50 ft.; over 4 in., 100 ft. At changes in direction greater than 45°. Install at base of soil, waste, vent, stacks and roof conductors and where called for.

B. Cleanouts: Same nominal size as pipe, but not larger than 4 in.

### 3.03 WALL HYDRANTS

A. Install minimum 24 in. above grade.

3.04 HOSE BIBBS

A. Install at low points of piping system.

3.05 SHOCK ABSORBERS

A. Install in vertical position.

3.06 THERMOMETERS

A. Provide on piping system where called for and shown, with thermometer well at each location, mounted in oversize tee or elbow to provide as little restriction as possible to fluid flow, stems or proper length to allow accurate reading. Arrange to be easily read from floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.07 PRESSURE GAUGES

A. Provide in piping system where called for and shown, with needle valve and pulsation damper or snubber at each location. Arrange to be easily read from the floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.08 TEMPERATURE MIXING VALVE

A. Provide where called for. Provide 2 ft. - 0 in. deep heat trap on hot water supply line ahead of connection to mixing valve.

B. Provide factory-trained technician to start up, adjust and inspect the mixing valve and piping for correct installation and temperature adjustment.

END OF SECTION

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SECTION 22 32 00
COMPRESSED AIR AND VACUUM EQUIPMENT

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and other services to perform operations required for the complete installation and related work as required in the Contract Documents.

B. Equipment listed in this section shall be used for laboratory and general use only.

1.02 SUBMITTALS

A. Submit shop drawings for all items specified in this section under Part 2 - Products.

1.03 EQUIPMENT MANUFACTURER

A. All system equipment specified under this section shall be provided by the same supplier.

B. Make arrangements for supplier's representative to supervise, inspect and test installation to assure system operates as specified.

## PART 2 - PRODUCTS

2.01 DISTRIBUTION PIPING

A. Refer to Specification Section 221010, "Piping Systems and Accessories".

B. Connections: All brazed connections except valves or equipment requiring threaded connections.

C. Fittings:

1. Vacuum: Long-turn drainage pattern, brazing type fittings.
2. Compressed Air: Brazing type fittings.

2.02 VALVES

A. Refer to Specification Section 220523, "Valves".

2.03 COMPRESSED AIR SYSTEM

A. Provide Champion Model HR15-12, or equivalent Ingersoll-Rand, base mounted, duplex compressors and motors, continuous duty rated two stage reciprocating type with sealed bearings, rated to produce a total of 97.4 CFM at 175 psig, and a maximum pressure of 175 psi. The compressor motor shall be NEMA rated, 15 HP at 480 volts, 60 Hz, three phase.

1. Wet-Receiver tank shall be ASME rated for 200 psig working pressure with liquid level gauge glass, safety relief valve, manual drain valve and a timed automatic solenoid drain valve. Tank shall be horizontal with a capacity of 120 gallons.
2. Dry-Receiver tank shall be ASME rated for 200 psig working pressure with liquid level gauge glass, safety relief valve, manual drain valve and a timed automatic solenoid drain valve. Tank shall be vertical with a capacity of 400 gallons.
3. Automatic start and stop operation duplex NEMA 12 control panel, with automatic lead/lag sequencing, circuit breaker disconnects for each motor, 120V control circuit transformer, audible and visual alarms, automatic alternation and Hand-Off-Automatic selector switches for each compressor. Provide two (2) year warranty.

B. Refrigerated Dryer:
1. General: Provide Ingersoll-Rand Model D170NC refrigerated air dryer or approved equal capable of reducing the temperature of 100 CFM air at 175 psig to a pressure dew point (33°F to 39°F). Include with automatic drain valve.
2. Dryer shall incorporate a hermetically sealed air cooled refrigeration compressor/condenser and liquid refrigerant filter dryer.
3. Dryer shall be equipped with a panel mounted evaporator light, power-on light and pre-wired power cord.
4. Electrical Requirements: 120 volts, 60 Hz, single phase.

C. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

D. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

E. Air-line Lubricators: Drip chamber and sight dome for observing oil drop entering air stream, with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated. Provide with automatic feed device for supplying oil to lubricator.

F. Safety Valves: ASME Boiler and Pressure Vessel Code: section VIII, "Pressure Vessels" construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety for compressed-air service.

G. Pressure Regulating Valves:

1. Air-Main Pressure Regulators: Pilot operated, Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, rated for 250 psig inlet pressure
2. Air-Line Pressure Regulators: Diaphragm or pilot operated, Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, rated for 200-psig minimum inlet pressure.
3. Design Equipment: Cash Acme No. E-55, arranged for compressed air.

2.04 QUICK COUPLINGS:

A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

B. Automatic-Shutoff Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
1. Socket End: One-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug-end: straight-through type with barbed outlet for attaching hose.

C. Valveless Quick Couplings: straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
1. Socket End: O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug-end: Barbed outlet for attaching hose.

2.05 HOSE ASSEMBLIES:

A. Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
1. Hose: Reinforced double wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless steel O-ring or gasket seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: one-piece, straight-through brass or stainless steel fitting with barbed ends for connecting two sections of hose.

2.06 HOSE REELS

A. Compressed Air Hose Reels shall be Lincoln Model No. 85010-50 low pressure wheel for air with all accessories as required for a complete compressor reel assembly as manufactured by Lincoln Industrial, St. Louis, MO, or Alemite or Graco.

1. Fifty feet of half inch (1/2) air hose
2. Reel latch that automatically locks at desired position
3. Air chuck attachement for tire, Lincoln Model No. 6691 hand held meter.
4. Ball stop included
5. Maximum Pressure: 350 psi
6. Material Inlet/Outlet: half inch (1/2) NPT (female)

## PART 3 - EXECUTION

### 3.01 PIPING INSTALLATION

A. Installations:

1. All work in this section shall be done in accordance with the equipment manufacturer's installation instructions and the latest applicable Codes and NFPA requirements.
2. Provide rigid supports for all valves and equipment to avoid strain on piping.

B. Cleanouts:

1. Install cleanouts in vacuum piping at the top of each riser, at all 90° turns, etc. Use only "Y" type fittings; tees are not acceptable.

### 3.02 TESTING

A. After installation of tubing but before connecting to system components, test piping sections with a minimum 150 psig of oil free dry nitrogen.

1. Test each joint for leaks by means of soap suds.
2. All leaks shall be located, repaired and piping retested.

### 3.03 EQUIPMENT START-UP

A. Provide equipment start-up services by a factory-authorized technician based on factory recommendations. Technician shall inspect the work for proper installation, operation and to confirm specified operating parameters. Submit three (3) copies of startup reports with all factory checkout data in writing to the Owner's Representative.

END OF SECTION

SECTION 22 34 00
WATER HEATERS

## PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work of this section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions, General Requirements and Basic Mechanical/Electrical Requirements.

B. Provide labor, materials, equipment and services to perform work and related work required by Contract Documents for a complete operating system.

1.02 SUBMITTALS

A. Submit manufacturer's data for approval in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all products to be installed including, but not limited to:

1. Water Heater.
2. Tank Protective Valves.
3. Expansion Tank.
4. All Heater and Tank Accessories.
5. All System Wiring Diagrams.
6. Tank Lining.
7. Condensate Neutralizer Kit.

1.03 SPECIAL COORDINATION

A. Coordinate all work of other trades in Mechanical Room.

B. Furnish Division 26 "Electric" with dimensional drawings showing location of electrical connections, location of equipment mounted on walls, and of other equipment requiring electrical connections, removals or replacements.

## PART 2 - PRODUCTS

2.01 WATER HEATER COMMERCIAL GAS-FIRED, CONDENSING TANK TYPE

A. Provide 60 gallon 160 PSI ASME condensing tank type gas water heater with recovery rate of 138 at 100°F rise.

B. Provide units with 98% minimum thermal efficiency and sealed, submerged combustion chamber. Provide units with zero clearance capabilities from combustibles. Provide units with power burner and diagnostic electronic controls. Modulating burner with 5:1 turndown.

C. Provide AGA rated, ASME stamped temperature and pressure relief valve. Pipe to drain.

D. Provide venting as per detail sealed vertical using manufacturer approved CPVC Schedule 40, Polypropylene, or AL-294C stainless steel construction. Terminations per code.

E. Provide condensate drain for exhaust elbow.

F. Provide condensate neutralizer for drain.

G. Provide a three (3) year warranty against tank leakage.

H. Provide start up report from factory authorized service agent to include combustion efficiency, safety and operating control check and verification of proper venting.

I. Design Equipment: AO Smith CYCLONE Model Mxi Modulating.

J. Acceptable Manufacturers: AO Smith, Lochinvar, State, or approved equal.

2.02 WATER HEATER CONDENSATE NEUTRALIZER FILTERS

A. High density polyethylene or polypropylene, seamless construction, bolted access cover with collar and neoprene seal.

B. Limestones or marble chips, 1 in. to 3 in. size, quantity per basin manufacturer.

C. Acceptable Manufacturers: AO smith, Enfield, Orion or Sloan.

2.03 THERMAL EXPANSION TANK

A. Vertical steel expansion tank constructed and designed per ASME Code Section VIII, 125 PSI working pressure, steel outer shell, rigid polypropylene liner, heavy duty butyl rubber diaphragm and non-ferrous system connection tapping, suitable for potable hot water. Refer to drawing schedule for factory pre-charged pressure, volume, and maximum acceptance factors. The manufacturer will be similar to y Amtrol, Wessel or approved equal.

B. Design Equipment: Amtrol.

C. Acceptable Manufacturers: Amtrol, Watts, Wessel or approved equal.

2.04 TANK PROTECTIVE VALVES

A. Pressure Relief Valves:

1. ASME stamped and rated.
2. Open at 125 lbs. pressure sized for full heating capacity.
3. Make: Bell & Gossett, Kunkle, Watts or approved equal.

B. Temperature and Pressure Relief Valve:

1. ASME stamped and rated (for steam or hot water).
2. Size for full heat input.
3. Complying with Federal Spec. MIL-V-13612C.
4. Valve shall be sized and selected by manufacturer for tank and heater installed.
5. Make: Camco, Cash-Acme, Watts, or approved equal.

## PART 3 - EXECUTION

3.01 WATER HEATERS

A. Install each heater on a 4 in. high concrete pad.

B. Pipe pressure and temperature relief valve drain to discharge to nearest floor drain.

C. Provide all electric wiring and equipment in accordance with manufacturer's wiring diagrams and instructions. Make all final connections.

D. Provide all piping, valves and fittings in accordance with manufacturer's piping instructions. Make all final connections.

E. Provide equipment in accordance with contract drawings and all local codes.

F. Provide gas pressure regulator when inlet gas pressure exceeds 14 in. w.c.

G. Provide start-up services of a factory trained technician to inspect the installation based on factory recommendations. Items include but are not limited to:

1. Verification of proper piping arrangement.
2. Fuel supply piping and connection(s).
3. Combustion efficiency.
4. Verification of proper temperature rise across heater(s).
5. Verification of proper venting with draft reading.
6. Operating and safety controls.
7. Proper operation of equipment.
8. Verification of piping arrangement and aquastat location.
9. Verification of proper gas pressure to unit and to burners.
10. Relief valve settings and AGA BTU capacities.
11. All control settings.

H. Submit three (3) copies of startup reports in writing with all factory checkout data signed by the factory authorized service agent to the Owner's Representative.

I. Place equipment in operation.

J. The installation of water heaters shall be based on the details shown on the drawings and specified in this Section. Approved water heaters provided other than type shown or specified shall be installed in accordance with manufacturer's recommended installation instructions and piping diagrams.

3.02 CONDENSATE NEUTRALIZERS

A. Verify if condensate neutralizer is available from factory to be provided with water heater to site.

B. Install unit with 1/2 in. polyethylene or polypropylene tubing or piping in accordance with the water heater manufacturer's recommendations.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES AND TRIM

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 - Products of this section.

1.03 DESCRIPTION OF FIXTURES

A. Fixtures and trim shall be of those manufacturers listed, unless otherwise indicated. Fixtures for this project shall be of same manufacturer.

1. Fixtures: American Standard, Kohler, Mansfield, Sloan, Toto, Watts or Zurn.
2. Faucets: Chicago Faucets, Delta, Moen, Symmons, T&S Brass or Zurn. All faucets shall be lead-free in accordance with NSF 61 and NSF 372.
3. Flushometers: Sloan "Regal XL" or Zurn.
4. Closet Seats: Bemis, Beneke, Church or Olsonite.
5. Fixture Carriers: Jay R. Smith, Watts, Wade, Josam or Zurn.
6. Sinks: Elkay, Just or Kohler.
7. Water Coolers: Elkay, Halsey Taylor or Haws.
8. Supplies, Stops and Traps: Brasscraft, EBC, McGuire or Sanitary Dash.

B. Exposed parts of trim shall have polished chrome plated finish.

C. Tubular drainage products ("P" traps, nipples, etc.) shall be 17 gauge brass.

1.04 QUALITY ASSURANCE

A. Comply with requirements of the Plumbing Fixture Law of the New York State Department of Environmental Conservation.

B. Comply with the American Disabilities Act Guidelines and ANSI A117.1 "Accessible and Usable Buildings and Facilities".

C. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard 61, Section 9 Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third-party testing and certification.

D. All fixture trim used to convey water for potable use shall be lead free.

## PART 2 - PRODUCTS

2.01 WATER CLOSETS

A. WC-A (ADA):

1. American Standard #2257.101 Afwall, wall hung, vitreous china, siphon jet, elongated bowl, 1.28 GPF, fully glazed 2 in. ball pass trapway, with 1-1/2 in. top spud, fitted with following:

   a. FV-A flush valve as specified herein.

   b. Church #9500SSC, extra heavy weight, white elongated solid plastic, open front closet seat with combination self-sustaining check hinges, less cover.

   c. Jay R. Smith Series 200 closet fittings and carrier.

   d. Mount at ADA required height and location or as shown on Architectural drawings.

2.02 URINALS

A. UR-A (ADA):

1. American Standard #65901.501, Washbrook 0.5 GPF, wall hung, vitreous china, washout urinal with extended shields, stainless steel strainer, outlet connection threaded 2 in. female, 3/4 in. top spud, fitted with following:

   a. FV-U flush valve as specified herein.

   b. Jay R. Smith Series 637 carrier with rectangular uprights, bearing and base plates.

   c. Mount at ADA required height and location or as shown on Architectural drawings.

2.03 FLUSH VALVES

A. FV-A: Sloan #8111-1.28 GPF, sensor operated, battery powered, closet flushometer, for left or right hand supplies, exposed diaphragm type, 1 in. screwdriver angle stop with vandal resistant metal cap and replaceable sensor window, bumper on stop, vacuum breaker, adjustable tailpiece, sweat solder adaptor kit, cast wall flange with set screw, override button, adjustable sensor on centerline of fixture, sentinel flush every 24 hours after last flush, low battery flashing LED and powered by (4) size AA batteries, 3 year battery life @ 4,000 flushes per month.

B. FV-U: Sloan #8186-0.5 GPF, sensor operated, battery powered, urinal flushometer, for left or right hand supplies, exposed diaphragm type, 3/4 in. screwdriver angle stop with vandal resistant metal cap and replaceable sensor window, vacuum breaker, adjustable tailpiece, sweat-solder adaptor kit, cast wall flange with set screw, override button with adjustable sensor on centerline of

fixture, sentinel flush every 24 hours after last flush, low battery flashing LED and powered by four (4) size AA batteries, three (3) year battery life @ 4,000 flushes per month.

2.04 LAVATORIES

A. LAV-A (ADA):

1. American Standard #0355.012 Lucerne, 20 in. x 18 in., wall hung, vitreous china lavatory with 4 in. centers, front overflow, self-draining deck and punching for concealed arm carrier, fitted with following:

   a. F-A faucet as specified herein.

   b. McGuire #155WC offset chrome plated P.O. plug with open grid strainer and 1-1/4 in., 17 gauge offset tailpiece.

   c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.

   d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers, cast brass escutcheon with set screws.

   e. Jay R. Smith Series 700 concealed arm floor mounted carrier with rectangular uprights.

   f. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".

   g. Mount at ADA required height and location or as shown on Architectural drawings.

B. LAV-B (ADA):

1. American Standard #0497.221, 21-1/2 in. x 17 in. oval, undermount, vitreous china lavatory with front overflow, fitted with the following:

   a. F-A faucet as specified herein.

   b. McGuire #155WC offset chrome plated P.O. plug with open grid strainer and 1-1/4 in., 17 gauge offset tailpiece.

   c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.

   d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers and cast brass escutcheons with set screws.

   e. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".

2.05 SINKS

A. SK-A (ADA):

1. Elkay Lustertone LRAD2219, 22 in. x 19 in. x 6 in. deep, nickel type 302 stainless steel single bowl sink, ADA compliant, three (3) faucet holes, 18 gauge, self-rimming for countertop installation, fitted with the following:

   a. F-B faucet as specified herein.

   b. Elkay #LKAD35 strainer with removable cup, LKADOS 1-1/2 in. O.D. offset tailpiece.

   c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

   d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

2.06 FAUCETS

A. F-A:

1. Chicago Faucets Hytronic #116.221.AB.1, dual supply, with user adjustable temperature mixing valve and integral checks, CP solid cast brass electronic sensor faucet, battery operated, deck mounted, 4 in. centers, lead-free, cover plate, vandalproof non-aerating spray outlet, stainless steel braided hose supply, ADA compliant and fitted with the following:

   a. 0.50 GPM aerator.

   b. Chicago #131-ABNF, lead-free, thermostatic mixing valve, 3/8 in. connections.

   c. 6 volt lithium CRP2 battery.

   d. ADA compliant, chrome plated.

B. F-B:

1. Chicago #431ABCP, single lever washerless sink faucet, integral 9-1/2 in. cast brass swing spout, temperature limiter, deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:

   a. 2.0 GPM aerator.

   b. Chicago #131-ABNF, lead-free thermostatic mixing valve, 3/8 in. connections.

   c. #317 4 in. wrist blade handles.

   d. ADA compliant.

2.07 SERVICE SINK

A. SS-A:

1. American Standard Akron #7695.008, 24 in. x 20 in. cast iron acid resisting, drilled back, enameled one-piece service sink with stainless steel rim guard on three sides, supported on wall hanger and fitted with the following:

a. T&S Brass #B-0665-BSTP, lead-free, exposed sink faucet with integral stops, hose end spout with bucket hook, vacuum breaker, union couplings, threaded 1/2 in. outside, rough plated body.

b. American Standard #7798.030 3 in. cast iron acid resisting enameled inside adjustable trap standard with cleanout plug and strainer.

2.08 MOP BASINS

A. MB-A:

1. Fiat Model MSB, molded stone, 24 in. x 24 in. x 10 in. deep, stainless steel flat strainer, 2 in. outlet with the following:

a. T&S Brass #B-0665-BSTP, lead-free, exposed wall mounted faucet with integral stops, rough chrome finish, lever handles, top brace spout with bucket hook, hose end and vacuum breaker.

b. Fiat # 832AA Hose and Hose Bracket.

c. Fiat #889CC Mop Hanger.

d. Fiat # E77AA Vinyl Bumper guard on exposed sides.

e. Fiat #MSG 2424 Stainless Steel Wall Guard.

f. Provide silicone sealant between wall, floor and mop basin.

2.09 SHOWERS

A. SH-A (SHOWER, ADA):

1. Aquatic Advantage #16030BFSC, 62-3/8 in. x 32-3/4 in. x 78-1/2 in. (exterior), one piece shower cabinet, white acrylic with fiberglass and polyester resin backing, smooth wall, 2 in., chrome plated cast brass center drain, for right or left hand valves as indicated on drawings and fitted with the following:

a. Reinforcement to accommodate grab bar locations.

b. Grab bars.

c. Fold-up shower seat, soap dish, curtain rod.

d. Vinyl flexible dam.

e. Fixed shower head and hand-held shower system.

f. Moen commercial T8346EP15, 1.5 chrome finish trim, WaterSense certified.

g. Moen single handle Posi-Temp pressure balancing shower valve with check stops maximum temperature stop.

h. Hand-held shower with non-positive pause, 30 in. slide bar, drop ell, 69 in. metal hose and mounting hardware.

i. Cabinet shall be set in a bed of mortar.

2.10 EMERGENCY SHOWER AND EYE/FACE WASH (FREE-STANDING)

A. Equal to Speakman #SE-607 free-standing emergency shower complete with deluge shower head, stay open valve with rigid pull rod and ring, stanchion floor flange, interconnecting fittings, aerated eye/face wash, 1/3 in. full flow valve activated by hand and foot with stainless steel bowl.

2.11 ELECTRIC WATER COOLER

A. EWC-A:

1. Elkay #EZSTL8C two level wheelchair access model, wall mounted, ADA compliant, lead-free construction, type 304 stainless steel cabinet, one piece stainless steel basin, flexible bubbler, self-closing front and side push bar control on each side with in-line stream regulator, adjustable temperature control, permanently sealed and lubricated fan motor, hermetically sealed compressor and motor, 1/5 hp, 120V, capacity of 8.0 GPH at 80°F inlet water, 50°F outlet water with room temperature of 90°F, with optional #LKAPREZL apron, fitted with the following:

a. McGuire #LF165LKE, lead-free, 3/8 in. lavatory wall supply with loose key angle stop, 3/8 in. flexible tube riser, cast brass escutcheon with set screw.

b. McGuire #8902, 1-1/4 in. x 1-1/2 in. semi-cast brass "P" trap with cleanout and cast brass escutcheon with set screw.

c. Jay R. Smith floor mounted carrier with rectangular uprights.

d. Acceptable Manufacturers: Elkay, Halsey Taylor.

## PART 3 - EXECUTION

3.01 FIXTURES, EQUIPMENT AND SYSTEMS

A. Install fixtures, equipment and systems as shown on Drawings or specified herein in accordance with provisions of each applicable Specification Section and all local and state codes having jurisdiction.

3.02 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers written installation instructions.

B. Carefully drill holes for through bolts to avoid chipping blocks or plaster.

C. Except where carriers are specified, attach hangers or brackets to walls as follows:

1. Masonry Construction: Secure fixture hangers to partition by thru-bolts extending through a steel plate on opposite side of partition. Obtain Owner's Representative's approval prior to work.

2. Metal Stud Construction: Anchor backing for fixtures or equipment to 1/8 in. x 12 in. steel plate bolted or riveted to at least three studs. Obtain Owner's Representative's approval prior to work.

D. Anchor carriers to concrete floor with 1/2 in. x 3 in. anchor or thru-bolts and washers. Provide for drilling of floor and installation of expansion shields. Quantity of anchors:

1. Water Closets - Four (4).

2. Lavatories - Eight (8).

3. Urinals - Eight (8).

E. Seal fixtures in contact with walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone caulk. Match color to fixture color.

F. Set self-rimming lavatories and sinks in a bed of silicone caulk.

G. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

H. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.

I. Install wall-hanging, back-outlet urinals with gasket seals.

J. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.

K. Fasten counter-mounting-type plumbing fixtures to casework.

L. Metering faucets shall be adjusted for minimum ten (10) second run time, but not more than 0.25 gallons per cycle.

M. Immediately after installation, provide protective covering over fixtures and trim.

3.03 MOUNTING HEIGHT AND LOCATION

A. Mount fixtures at height and location as indicated on Architectural plans and elevations.

B. Mount accessible fixtures in conformance with the requirements of ANSI A117.1.

3.04 CONNECTIONS

A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

3.05 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Adjust water pressure at electric water coolers, faucets and flush valves to provide proper flow and stream.

C. Replace washers of leaking and dripping faucets and stops.

D. Clean fixtures, fittings, spout and drain strainers with manufacturers' recommended cleaning methods and materials.

E. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components and retest. Repeat procedure until all units operate properly.

END OF SECTION

SECTION 22 70 10
NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Provide manufacturer's data sheets and installation instructions for all equipment and accessories in this section in accordance with Basic Mechanical/Electrical Requirements and Division 01.

1.03 QUALITY ASSURANCE

A. Follow all requirements, recommendations, and appendices to comply with the following publications, codes, standards, and listings:

1. 2020 Fuel Gas Code of New York State.
2. American Gas Association.
3. Local Utility Company.

B. Provide equipment and accessories that are listed and labeled by a nationally recognized testing laboratory.

1.04 GAS SERVICE

A. All new underground gas service piping from the street main to, and including, the gas meter will be installed by CoEdison.

B. The cost of this work shall be included in this Contractor's bid.

C. This Contractor shall provide the meter pad, pipe bollards and meter enclosure.

1.05 GAS PRESSURE

A. The maximum allowable gas pressure inside the building is 1/2 psi.

1.06 UNDERGROUND GAS PIPING

A. All underground gas piping located downstream of the gas meter shall be installed by a ConEdison approved utility contractor in accordance with the gas company's requirements.

B. The cost of this work shall be included in this Contractor's bid.

## PART 2 - PRODUCTS

2.01 GAS PIPING

A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories" and Section 221020, "Underground Piping And Accessories".

B. All exposed exterior and interior piping shall be primed and painted with one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel. Color shall be as selected.

2.02 VALVES

A. Refer to Specification Section 220523, "Valves".

2.03 GAS PRESSURE REGULATORS

A. Cast iron body, die-cast aluminum alloy diaphragm case, field adjustable, removable orifice, internal relief valve, threaded connections, lockup style.

B. Inlet pressure 27 in. wc, outlet pressure 14" in. wc, 0 to 3,700 CFH.

C. Design Equipment: Sensus.

D. Manufacturers: Sensus, Fisher Controls or approved equal.

2.04 GAS METER

A. Rotary type, 175lb meter, flanged connections, aluminum case, polished aluminum impellers, tamper resistant, counter with instrument drive, pulse output, temperature compensated.

B. Capacity: 3,700 CFH, inlet gas pressure 0.5 psi.

C. Design Equipment: Dresser Series B3 Roots Meter.

D. Manufacturers: Dresser, Sensus, American Meter or approved equal.

2.05 FLEXIBLE CONNECTORS

A. Stainless steel construction and in accordance with ANSI Z21.24.

2.06 GAS METER PAD

A. 3000 psi concrete pad on 12 in. gravel base, depth, length and width as required by the utility company.

2.07 GAS METER FENCE ENCLOSURE

A. Chain-link fabric, framework and fittings shall be hot-dipped galvanized produced to conform to ASTM-120.

B. Intermediate Posts, Gate Post and End Post: 3 in. O.D., Schedule 40 steel, with caps.

C. Top and Bottom Rails: 1-5/8 in. O.D., Schedule 40 steel.

D. Fabric: Hot dipped galvanized steel 2 in. mesh, 9 gauge, 84 in. high with knuckle top.

E. All fencing materials enclosing gas meter-regulator assemblies shall meet or exceed requirements of utility company.

2.08 LOCATOR TAPE

A. Yellow plastic tape, intended for direct-burial service, not less than 6 in. wide x 4 mils thick with #10 AWG coated stranded copper wire tracer. Lettering on the tape shall state, "CAUTION: BURIED GAS LINE BELOW".

B. Manufacturers: Calpico, Griffolyn, Terra Tape or approved equivalent.

**PART 3 - EXECUTION**

3.01 ARRANGEMENTS

A. Make arrangements with Patrick Farrell, Customer Project Manager for Consolidated Edison Company of New York, Inc., Cell: 646-245-6993 / Office: 914-789-6079 to provide the gas service and meter at the indicated location.

B. Contact the utility company for the cost of the service, its fees and required permits. Pay all costs and include within the base bid.

C. The service load is 3,700,000 Btuh. The pressure at the meter outlet shall be set at 14 in. wc.

D. Coordinate all service requirements with the utility company.

E. The contractor shall arrange for the plumbing inspector to inspect the gas piping and vent installations upon completion including underground and rough-ins, as well as installation of gas-fired appliances.

3.02 GAS METER PAD

A. Provide concrete pad on 12 in. gravel base. Verify exact size and placement of meter pad with the utility company.

B. Provide with 6 x 6, 10/10 WWM in top one-third of the concrete meter pad.

3.03 GAS METER FENCE ENCLOSURE

A. Provide chain link fence enclosure with roof and locked swing gate at each exterior gas meter location. Enclosure size and swing gate at location required by utility company. Minimum 14 ft. x 6 ft. x 7 ft. high with 4 ft. swing gate.

B. Installation of fencing shall meet the requirements of ASTM F-567 (Part 3) and utility company.

C. All posts shall be set in minimum 12 in. diameter concrete to at lease three feet below grade. Posts shall extend a minimum of 7 ft. above grade.

D. Intermediate post shall be spaced a maximum of 10 ft. on center. Posts shall be provided at all corners, ends and gate openings.

E. Posts shall be set at least 24 in. away from any part of the gas meter-regulator assembly or as required by utility company.

F. Entire fenced area extending a minimum of 6 in. outside of the enclosure shall be surfaced with a layer of crushed stone, a minimum of 6 in. thick. Place stone atop black landscaping fabric.

3.04 GAS DISTRIBUTION SYSTEM

A. Provide distribution system from gas meter outlet, including meter pad, fence enclosure, mains, risers, branches, drips, shut-offs and other required parts. Connect to equipment or appliances indicated or specified as requiring gas for their operation.

B. Provide shutoff valve at the meter outlet. Provide all parts and accessories needed to connect to meter.

C. Furnish sleeve and sealing element for above ground gas piping entry through outside wall. Make entry gas and watertight.

3.05 PIPING INSTALLATION

A. Install gas piping at a uniform slope of 1/4 in. in 15 ft. to prevent traps. Horizontal lines shall slope upward to risers to the equipment.

B. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.

C. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down. Connect branch piping from top or side of horizontal piping.

D. Install unions in pipes 2 in. and smaller, adjacent to each valve, regulator and at final connection to each piece of equipment. Unions are not required on flanged devices.

E. Provide pressure regulator in supply to each gas fired appliance as required.

F. Install valve and strainer on the supply side of each gas pressure regulator.

G. 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.

H. Install containment conduits for buried gas piping within building in gas-tight conduits extending 12 in. minimum 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.

I. Install pressure-relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.

J. Install gas piping across exit corridors within an airtight conduit constructed of Schedule 40 seamless black steel pipe with welded joints. Vent conduit to outside of exit corridor.

3.06 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by the Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth; remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in. for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. Exercise caution to prevent heat related damage to plastic parts within the gas meter or regulators.

B. Welder qualifications: Welded piping fabricated by certified welder. Welder shall be certified under ASME or API Code III.

3.07 CONNECTIONS

A. Install gas piping next to gas-utilizing equipment and appliances for servicing and maintenance. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections to equipment downstream of valves and unions with flexible connectors. Valves, unions and flexible connectors shall be same size as the gas supply piping to the equipment.

B. Install a gas valve upstream within 6 ft. of each gas-utilizing appliance. Install a union connection downstream from the valve to permit removal of controls.

C. Sediment Traps: Install full size tee fittings forming drips, as close as practical to gas appliance inlets. Cap or plug bottom outlet.

3.08 UNDERGROUND PIPING INSTALLATION

A. All underground piping shall be installed by a utility approved contractor in accordance with the gas company's requirements.

B. Qualification by the utility company is required for the individual making heat-fusion joints.

C. The service main shall be installed with a minimum 36 in. cover and shall in all cases conform to be requirements of the pipe manufacturer instructions.

D. Install piping a minimum 5 ft. - 0 in. from buildings.

3.09 LOCATOR TAPE

A. Install the locator tape with the gas main, which can be used to help determine the location of the gas piping at a future time. Locate directly over the buried gas line at a depth of 6 in. below finished grade.

B. Terminate tracer wire in cast iron boxes. Maximum spacing between boxes shall be 500 ft.

3.10 GAS PIPING TESTS

A. Test natural gas systems according to 2020 Fuel Gas Code of New York State and the local utility requirements unless otherwise noted:

1. Test pressure shall be 1-1/2 times working pressure, but not less than 3 psi for two (2) hours for steel piping.
2. Pressure testing of plastic piping shall be per utility's requirements.

B. Tests shall be witnessed by utility company. Make arrangements, provide all necessary items to complete testing and pay all costs.

C. All tests shall be performed prior to the connection of equipment. Regulator shall be isolated from test pressures. Soap test shall be conducted on all joints. Repair leaks and defects with new materials. Retest system until satisfactory results are obtained.

D. Verify correct pressure settings for pressure regulators.

E. Provide written certification that tests have been conducted and satisfactorily completed. Submit to Owner's Representative.

3.11 GAS LINE PURGING

A. At completion of pressure test, purge all natural gas systems according to 2020 Fuel Gas Code of New York State and the utility company requirements.

B. Provide three (3) days notice to utility company to have the meter unlocked for service and equipment start up. Make all arrangements and pay all fees as required by the Utility Company.

END OF SECTION

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SECTION 23 05 04
ELECTRIC WIRING

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of motor control wiring and temperature control wiring as required in Contract Documents. Provide wiring and conduit, required to connect devices furnished as part of or adjunctive to the automatic temperature control system and for motor control regardless of the source of supply. Control wiring includes 120 volt and lower voltage wiring for control signals directing equipment operation. Control circuits shall be 120 volt maximum. Provide wiring in accordance with requirements specified in Division 26, "Electrical" and the National Electrical Code. Provide devices required for proper system operation, including special electrical switches, transformers, disconnect switches, relays, and circuit breaker protection.

B. Coordinate all work with Division 26, "Electrical".

1.02 WORK NOT INCLUDED

A. Power wiring for motors, motor starters and associated starting and control equipment, as well as the motor starters (except in the case of equipment specified to have packaged control/starters), are included in Division 26, "Electrical", unless otherwise called for.

1.03 QUALIFICATIONS

A. Wiring shall be installed in compliance with all requirements of Division 26, "Electrical".

1.04 SUBMITTALS

A. Provide complete wiring diagrams for equipment systems. Deliver wiring diagrams to proper trades in time for roughing of conduit, equipment connections, and avoid delay in construction schedule. Wiring diagrams and roughing information to be wired as part of the Work of Division 26, "Electrical", shall be clearly indicated.

## PART 2 - PRODUCTS

2.01 PRODUCTS

A. Refer to Division 26 specifications for required wiring materials.

## PART 3 - EXECUTION

3.01 GENERAL

A. Check electrical wiring pertaining to equipment for completeness and correctness of connections. Correct any misapplied motor and/or motor starter, improper thermal overload device, or device which fails to function and resultant damage, whether due to incorrect connections or improper information on wiring diagrams.

3.02 WIRING FOR CONTROL SYSTEMS

A. Provide motor control and temperature control wiring for equipment. All wiring shall be in conduit, unless otherwise noted. Refer to Section 260501 for type of conduit to be used in specific applications. Provide 18 in. length flexible conduit at motors and devices subject to vibration. Conduit supported on 5 ft. centers. Do not attach directly to hot surfaces, piping, or ductwork. Control wiring shall be in separate conduit from all other wiring. Provide green grounding wire circuited from starter, and run ground wire through conduit to each remote auxiliary relay, pushbutton station, remote panel heating device, thermostat, or device with potentials in excess of 50 volts. Size ground wire as required by NEC.

B. All temperature control wiring shall be plenum rated type, meeting the requirements of NEC Article 300.

C. Provide pushbutton stations, pilot lights, selector switches, auxiliary starter contacts, and other devices required to provide specified functions.

D. Where allowable by Code and contract documents, temperature control wiring may be installed without conduit. Installation and wire insulation types shall be as described by NEC, Article 725. All low voltage wiring circuits 50 volt and under shall:

1. Be adequately supported using bridle rings spaced a maximum of 3 ft. on centers or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.

2. Be installed in conduit when run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.

3. Be installed in conduit when installed vertically in Mechanical/Utility Rooms from panels and devices up to above ceiling, or 10 ft. above finished floor if no ceiling.

4. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.

3.03 EQUIPMENT WIRING

A. Provide power and control wiring between sections of electrical radiation units, between shipping splits, and between remote panels, thermostats, disconnect

switches, and their respective units. Provide control wiring from the package control system, to each respective electric heat coil, reheat coil or motor. Properly mount control package. Power wiring to and including disconnect switch shall be by Division 26 "Electrical".

3.04 FIELD WIRING IN STARTERS, CONTROLLERS AND PANELS

A. Wiring within starters, controllers, and temperature control panels, shall be routed neatly in gutter space, away from moving and/or heat producing parts. Provide suitably rated terminal blocks. Do not place more than two wire connections on pilot device or relay terminal. Where more than two circuit connections are required, use terminal blocks. Provide nylon insulated, ring spade terminal for all control wires. Cables and wires shall be neatly bundled and lashed with nylon cable straps.

END OF SECTION

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SECTION 23 05 13
MOTORS AND ADJUSTABLE SPEED DRIVES

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Submit manufacturer's product data on all motors and adjustable speed drives.

B. Product Data: For each motor, provide dimensions; mounting arrangements; frame type, enclosure type, location for conduit entries; shipping and operating weights; and manufacturer's technical data on features, performance, electrical ratings and characteristics.

C. Motor Performance Data: For each motor, include the following manufacturers' data:

1. Motor Performance: Percent Efficiency, Power Factor, Torque, RPM, Duty Rating and Design Category.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Motor manufacturer shall be based and headquartered in the United States of America and shall design and manufacture motors in the United States.
2. Motor manufacturer shall have over fifteen (15) years-experience in the motor industry and shall maintain active company-wide quality assurance program.
3. Motor manufacturer shall maintain an authorized service center within 60 miles of the project site, capable of providing training, parts and emergency maintenance and repairs.

B. Motor performance shall be warranted against material and workmanship defects by manufacturer's limited warranty and service policy.

1. Premium efficiency motors shall be warranted for 36 months.
2. Severe duty motors (as applicable) shall be warranted for 60 months.
3. Extended warranty shall be offered for certain products or as agreed by additional terms and specified elsewhere.

## PART 2 - PRODUCTS

2.01 MOTORS

A. General Requirements:

1. Motors built for 60 Hz operation, three phase for 1/2 HP and larger; single phase for 1/3 HP and smaller.

   a. In compliance with NEMA Standards, wound specifically for nameplate voltage, and selected for appropriate duty and environment.

   b. 1.15 minimum service factor at rated voltage and frequency.

   c. Bearings: Bearings shall have a rated fatigue life of L-10 (B-10) of 150,000 hours for direct-coupled applications and 50,000 hours for belted applications minimum. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG 1-14.43. The calculation will be determined from the pulley centerline being at the end of the motor shaft.

   d. V-belt connected motors with adjustable slide rail bases and pulleys.

   e. Motors shall have Class F insulation system, with Class B temperature rise, insulation meeting NEMA MG 1 Part 31. Maximum allowable motor temperature rise for open drip-proof or totally enclosed fan cooled (TEFC) type at 1.15 service factor shall be 115°C above 40°C ambient with a total temperature rating of 155°C.

   f. NEMA locked rotor kVA code as required to match unit equipment torque characteristics.

   g. Single-phase motors shall be capacitor start, induction run, or split phase type.

   h. Polyphase motors shall be constant speed, squirrel cage, unless otherwise specified.

   i. Nameplates shall have as a minimum, all information as described in NEMA Standard MG-1-20.60. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins.

2. Motors for use with adjustable speed drive applications shall be premium efficiency inverter duty rated in accordance with NEMA and be capable of a 20:1 turndown.

   a. These motors shall meet NEMA corona inception voltage requirements, withstanding peak voltages up to 1600 volts, and be manufactured in accordance with NEMA MG 1 Part 30 and 31.

   b. All motors controlled by adjustable speed drives shall be equipped with circumferential micro-fiber shaft grounding rings to provide protection from electrical bearing damage, to meet NEMA MG 1,

31.4.4.3. Provide Bearing Protection Ring Kit installed in accordance with the manufacturer's recommendation. For motors controlled by adjustable speed drives and 50hp or greater the motor shall have a ceramic electrically insulating bearing assembly on the opposite end of the grounding brushes

3. Three phase motors rated 1 HP and greater shall be copper winding, re-lubable ball bearings, 1.15 service factor, premium efficiency, energy-saver type with a guaranteed NEMA nominal full-load efficiency, by IEEE Standard 112 Test Method "B". Efficiency rating shall appear on nameplate, and shall be not less than as follows; per NEMA MG 1 Part 12, Table 12-12, nominal minimum efficiencies:

| **MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY** | | | | | | |
|---|---|---|---|---|---|---|
| **HP** | **ODP MOTORS (RPM)** | | | **TEFC MOTORS (RPM)** | | |
| | **1200** | **1800** | **3600** | **1200** | **1800** | **3600** |
| 1.0 | 82.5 | 85.5 | 77 | 82.5 | 85.5 | 77.0 |
| 1.5 | 86.5 | 86.5 | 84 | 87.5 | 86.5 | 84 |
| 2.0 | 87.5 | 86.5 | 85.5 | 88.5 | 86.5 | 85.5 |
| 3.0 | 88.5 | 89.5 | 85.5 | 89.5 | 89.5 | 86.5 |
| 5.0 | 89.5 | 89.5 | 86.5 | 89.5 | 89.5 | 88.5 |
| 7.5 | 90.2 | 91.0 | 88.5 | 91.0 | 91.7 | 89.5 |
| 10 | 91.7 | 91.7 | 89.5 | 91.0 | 91.7 | 90.2 |
| 15 | 91.7 | 93.0 | 90.2 | 91.7 | 92.4 | 91.0 |
| 20 | 92.4 | 93.0 | 91.0 | 91.7 | 93.0 | 91.0 |

4. Nominal Motor Voltage Table:

| **Nominal System Voltage** | **Motor Nameplate** |
|---|---|
| 480V - 3 phase | 460 volt |
| 240V - 1 phase and 3 phase | 230 volt |
| 208V - 1 phase and 3 phase | 200 volt |
| 120V - 1 phase | 115 volt |

5. Motor Application; Provide the following enclosure types unless noted otherwise:

| Environment/Location | Motor Enclosure Type |
|---|---|
| General Purpose | Open drip-proof, TEFC with cast iron frame, or encapsulated |
| Outdoors, below grade or high humidity | TEFC with cast iron frame |
| Hazardous | Explosion-proof |
| Packaged Refrigeration Compressors | Hermetic or semi-hermetic |

6. Acceptable Manufacturers: Motors need not all be of the same manufacturer. Subject to the requirements of this section provide products by the following:
   a. General Electric Energy & Saver NEMA Premium Efficiency/(ODP); General Electric X$D Ultra NEMA Premium Efficiency (TEFC).
   b. Century/A.O. Smith Speed Plus
   c. Baldor-Reliance Super E.
   d. Lincoln Ultimate E CTAC.
   e. Marathon XRI.
   f. Siemens GO100A.
   g. Nidec Motor Co. (U.S. Motors) Premium Efficient.

B. Adjustable Speed Drives (ASD's):
1. The ASD shall be 5 HP minimum size, UL Listed, NEMA standard frame size for horsepower rating indicated including 115% motor service factor. Short circuit rating shall be 42kA minimum. Integral solid state programmable overload relay with selectable time class (10, 20 or 30) shall be provided.
2. Units shall be wall or floor mounted as suitable for the intended location. Units shall be an integral component of a motor control center where indicated. Units shall be in NEMA 1 enclosure.
3. The unit shall be provided with a 120V control power transformer. The control power transformer shall be provided with primary and secondary fusing.
4. Cooling fans shall have removable washable filter.
5. Unit shall be of pulse width modulating design with separate common mode choke on the input and output of the drive, if not already built in the

unit to minimize total harmonic distortion. Provide with 3% input and output line reactor.

6. The allowable conductor length between the unit and the controlled motor shall be at least 300 ft. for a standard rated motor. Ambient temperature range shall be 0 to 40ºC with a 3300 ft. altitude.

7. Door mounted selector switch for Auto-Manual control. In the auto mode, the start command and speed control shall be provided from a remote source. In the manual mode, the start-stop and speed control shall be provided through the door mounted controls. Provide extra contact blocks on the selector switch for monitoring of switch position.

8. Door mounted pushbuttons for start-stop control. Stop pushbuttons shall always be active. Door mounted LED type pilot lights for indication of On (Red) and Off (Green). Door mounted human interface module for programming, display and speed control.

9. Programming shall include:

    a. One isolated, configurable analog input.

    b. Two isolated, configurable analog outputs.

    c. Alarm digital input for automatic shutdown, field configurable for ramped deceleration, full stop and manual/auto reset. Digital input to force unit to a preprogrammed speed for smoke control or other need.

    d. Four field programmable digital outputs.

10. Field selectable isolated process control interface to enable the ASD to follow 0-5 mA, 1-5 mA, 4-20 mA, 10-50 mA, 0-8 VDC, 1-4 VDC, or 0-10 VDC grounded or ungrounded signal from a process controller. Provide RS232 or RS485 communication module board.

11. Network connection shall be suitable for unit on/off and speed control. Communication to the building control system shall include actual motor speed verification, amperage, voltage, kW, and kWh. All unit programming functions shall be accessible through network communication. Communication shall be selectable for BACnet, Metasys, Modbus, Lonworks, Profibus and the project building control system.

12. Isolation Disconnect Switch: Provide isolation disconnect switch integral to unit with a provision for padlocking in the "Off" position.

13. Drive shall be a part of a unit with a three contactor isolated manual drive bypass as described below:

    a. The manual isolated drive bypass unit will consist of two units - a bypass starter unit and an adjustable speed drive (ASD) unit. The intent of the manual isolated drive bypass unit is to isolate the adjustable speed AC drive for servicing. The ASD unit door shall be interlocked with the bypass starter unit. When in the bypass mode the motor can be energized and de-energized with the across-

the-line bypass starter. Starter shall meet the requirements of a magnetic starter defined in this section.

b. All power components shall have a normal duty rating suitable for the nominal horsepower of the application.

c. Bypass Starter Unit: The bypass starter unit shall include the fusible disconnect or circuit breaker, the bypass contactor and solid state overload relay, control circuit transformer and terminal blocks. "DRIVE ON" and "BYPASS ON" pilot lights shall be provided to indicate operational status. Shall be three contactor design.

d. ASD Unit: A "DRIVE-OFF-BYPASS" selector switch, a "BYPASS START" push button and a "BYPASS STOP" push button shall be provided. These pilot devices shall be located in the same control station as the "DRIVE ON" and "BYPASS ON" pilot lights on the bypass starter unit.

e. Isolating Disconnect: The isolating disconnect shall be a six-pole device capable of making and breaking the load. Auxiliary isolating disconnect contacts will permit the operation of only one unit at a time either the Bypass Starter or the ASD.

f. Isolation Switch Operation:

1) Bypass Mode: When in bypass mode the "BYPASS ON" pilot light shall be energized when the bypass motor control circuit is energized. When in bypass mode the bypass starter unit and the ASD unit are isolated from one another. In addition, the isolation switch shall have means to be padlocked, to prevent being switched to drive mode. In this mode no power shall be present in the ASD enclosure.

2) Drive Mode: When in drive mode the isolating disconnect shall permit the starter bypass unit to supply power to the ASD unit and connects the ASD unit to the motor. When the isolation switch is in the drive mode the "DRIVE ON" pilot light shall be energized. In addition, the isolation switch shall have means to be padlocked to prevent being switched to bypass mode.

3) Unit shall be of three contactor construction.

14. Design Make: Allen Bradley Powerflex 700 with Drive Bypass.

15. Make: Allen Bradley, Eaton Corporation, Square D, General Electric, ABB, Emerson or approved equal.

## PART 3 - EXECUTION

3.01 MOTORS

A. Furnished by equipment manufacturer and especially manufactured and/or selected, mounted, and installed for intended use. Install motors accessible for maintenance and belt adjustment.

3.02 ADJUSTABLE SPEED DRIVES

A. Set controllers in place on wall or freestanding steel frame as required, with 6 in. high concrete base. Completely erect and assemble, including shipping splits and make respective connections from terminal or terminal strips to any miscellaneous control devices.

B. Provide power feed terminations with proper phase connections to provide proper motor rotation. Adjust unit controls in accordance with manufacturer's instructions.

C. Adjust unit controls in accordance with manufacturer's instructions.

D. A factory-trained manufacturer's service representative shall provide complete start-up services at the site during construction plus a separate (after startup on a 100% correctly operating drive) four (4) hour training session for the Owner.

END OF SECTION

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SECTION 23 05 16
VIBRATION ABSORBERS, EXPANSION COMPENSATORS AND EXPANSION JOINTS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Submit product data on items provided for each piece of equipment.

B. Submit detailed fabrication drawings for all field fabricated anchors.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Vibration Isolation for Piping: Section 230548 - Vibration Isolation of Mechanical Systems.

B. Anchors and Guides: Section 232010 - Piping Systems and Accessories.

## PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION FOR PIPING

A. Pipe runs connected to mechanical equipment should be mounted on steel spring and/or elastomer isolators as called for in "Vibration Isolation of Mechanical Equipment Specification 230548.

2.02 RADIATION GUIDES AND ANCHORS

A. For use with expansion compensators (see above) within fin radiation enclosures.

B. Two-piece full circumference nylon guide, bolted to "L" bracket. Keflex Model CTG, Tri-State Industries A-Series or equal.

C. Two-piece, bolted copper tube anchor and "L" bracket. Keflex Model CTA, Tri-State Industries C-Series or equal.

2.03 FLEXIBLE EXPANSION LOOPS

A. Provide flexible expansion loops of size and type as shown on the drawings, which will provide a flexible pipe loop that will absorb and compensate multi-plane movements simultaneously as well as reduce piping stress.

B. Materials of construction and end fittings type shall be consistent with pipe material and equipment/pipe connection fittings.

C. Flexible loops shall consist of two (2) flexible sections of hose and braid, two (2) 90° elbows and a 180° return assembled in such a way that the piping does not

change direction, but maintains its course along a single axis. Flexible loops shall have a factory supplied, center support nut located a t the bottom of the 180° return, and a drain/air release plug.

D. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be installed in a neutral, pre-compressed or pre-extended condition as required for the application.

E. Provide nested construction loops when installed in multiples. For steam service, loops must be installed with flexible legs horizontal to prevent condensate build up.

F. Provide guides and anchors as specified.

G. Loops shall be at 0 in. deflection at time of installation based upon 50°F ambient temperature. If the installation temperature is to be below 50°F, it is the Contractor's responsibility to review the installation with the Engineer before proceeding.

H. Make: Metraflex Co., Flex-Hose Co Inc., Flexi Craft Industries..

## PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Equipment installed in accordance with the manufacturer's installation instructions.

B. Piping shall be properly anchored to control the direction of expansion and guided at the entrance to expansion devices.

C. Expansion compensators and joints are sized based upon an ambient temperature of 50°F at the time of installation. If the installation temperature is to be below 50°F, it is the Contractor's responsibility to review the installation with the Engineer before proceeding.

END OF SECTION

SECTION 23 05 19
GAUGES AND THERMOMETERS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTAL

A. Submit product data for gauges, thermometers and thermowells.

## PART 2 - PRODUCTS

2.01 WATER PRESSURE GAUGES

A. Construction to be Bourdon tube type; 4-1/2 in. diameter minimum, dial face, stamped stainless steel, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip. 1/4 in. bottom connection. Accuracy, one (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber.

B. Make: American, Ashcroft, Crosby, Duro, Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

2.02 PIPING SYSTEM THERMOMETERS

A. Industrial type, plastic, aluminum or steel case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks where required; range as called for service. Universal adjustable type, 9 in. scale. For installation in hot water systems, graduations of 2°F., accurate to within 1°F. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F.

B. Make: American, Moeller, Trerice, Weiss, Weksler, Winters.

2.03 PRESSURE/TEMPERATURE TEST PLUGS

A. 1/4 in. NPT plug shall be capable of reading either a pressure or temperature. 1/8 in. o.d. dual seal core of Nordel 275°F with zero leakage from vacuum to 500 psig.

B. Test kit consisting of: one 2-1/2 in. test gauge 0-100 psi, one gauge adapter 1/8 in. probe, and two 5 in. stem pocket testing thermometers - one 0° to 220° and one 25° to 125°F.

C. Makes: Peterson Equipment Company, Sisco P/T plugs, IMI Flow Design.

## PART 3 - EXECUTION

3.01 GENERAL

A. Provide where called for in the drawings and as noted below.

B. All gauges and thermometers shall be provided with pressure and temperature ranges appropriate for the system in which they are installed. Select to operate in the middle third of the range under normal operating conditions. Gauges and thermometers shall be suitable for the environment of their installed location, and if installed outdoors shall be acceptable for operation down to an ambient temperature of -20°F.

3.02 WATER PRESSURE GAUGES

A. Heating water coils: 0 to 60 psi range.

B. Provide 1/4 in. ball valve in each pump inlet and outlet tapping, or in piping adjacent to same. Range 30 in. vacuum to 100 psi.

C. Each water make-up valve assembly: 0 to 60 psi range.

3.03 THERMOMETERS

A. Provide thermowells mounted in oversize tee, or elbow if necessary, to provide as little restriction as possible to fluid flow. Provide thermometer stems and thermowell depths of proper length to allow accurate reading. Locate adjacent to control sensing equipment. Install and adjust angles so as to be easily read from floor.

B. Boiler: Inlet and outlet; range 30° to 220°F.

C. Hot Water Zone: Supply and return pipe; range 30° to 220°F.

D. Radiant Heat: Supply and return; range 0° to 160°F.

E. Heating Coil: Inlet and outlet; range 0° to 220°F.

3.04 TEST PLUG

A. Provide test plugs at locations as called for. Deliver test kit to Owner and obtain receipt.

END OF SECTION

SECTION 23 05 23
VALVES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation and related Work designed in Contract Documents.

1.02 SUBMITTAL

A. Submit product data for valves and accessories.

## PART 2 - PRODUCTS

2.01 VALVES

A. General: Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.
2. Stem packing serviceable without removing valve from line.
3. Valves on insulated services shall have handle extensions so that the handle is fully beyond the insulation jacketing.
4. Where possible, all valves of like type shall be of a single manufacturer.

B. Acceptable Manufacturers:

1. Globe, and Check Valves: Apollo, Hammond, Milwaukee, Nibco, Watts.
2. Ball Valves: Apollo, Hammond, Jamesbury, Milwaukee, Watts, Nibco.
3. Butterfly Valves: Apollo, DeZurik, Jamesbury, Keystone, Milwaukee, Watts, Nibco.
4. High Performance Butterfly Valves: Keystone, Bray, Velan, Milwaukee.
5. To establish a standard of quality and to identify features, certain manufacturer's numbers are given in the following paragraphs.

C. Globe Valves:

1. 2-1/2 in. and Larger: Iron body, renewable seat and disc, 125 SWP, flanged ends, bolted bonnet, Milwaukee F-2981.
2. 2 in. and Smaller: Bronze body, renewable composition or bronze disc, union bonnet, rising stem, threaded ends, 150 SWP, Milwaukee 590.

D. Check Valves:

1. 2-1/2 in. and Larger: Iron body, renewable seat and disc, bolted flange cap, flanged ends, 125 SWP, Milwaukee F-2974.
2. 2 in. and Smaller: Bronze, swing check, threaded ends, 125 SWP, Milwaukee 1509.

3. Silent Check Valves, 2 in. and Smaller: Renewable seat, bronze body with bronze trim and stainless steel spring, 125 lb. SWP. Apollo 61-500 Series.

4. Silent Check Valves, 2-1/2 in. and Larger: Cast iron body, EPDM seat, aluminum bronze disc, 316 stainless steel spring and stem, 125 lb. SWP. Milwaukee 1400.

E. Ball Valves for Water Service:

1. For chilled and hot water systems 3 in. and under: Bronze body with hardened chrome-plated brass ball, glass reinforced or carbon impregnated PTFE seats, full porting, 600 lb., W.O.G., adjustable packing gland, insulated handle, screwed or soldered ends, blowout proof stem. Provide handle extension on insulated services.

2. Provide extended operations handle on non-thermal conductive material and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valves for Gauges and Instruments:

1. 1/4 in., bronze body, hardened chrome plated brass ball, glass reinforced carbon impregnated seats, standard porting, 400 lb. W.O.G., adjustable packing gland, screwed ends, tee handle, Watts B6000TH.

G. Lug Type Butterfly Valves for Water Service:

1. Rated for working pressure 200 psi, bi-directional dead end service, bubble-tight.

2. Body: Lug type, cast iron ASTM A126.

3. Disc: Aluminized bronze.

4. Seat: EPDM, resilient seat. Rated to 250ºF.

5. Stem: 316 or 416 stainless steel.

6. Operator: Lockable Lever for sizes through 6 in. Manual hand wheel gear actuator for sizes 8 in. and larger.

7. Milwaukee CL223E (2 in. - 6 in.), CL323E (8 in. and larger).

H. Gas Valves:

1. 2-1/2 in. and Larger: Manual actuated with level actuators bolted gland type, short pattern, lubricated plug type, 175 lb. WOG, flanged, Nordstrom, Fig. #143, UL listed.

2. 2 in. and Smaller: AGA/CGA and UL/FM listed for natural and LP gas, forged brass full port, threaded ends, Watts FBV Series.

I. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Provide valves of type called for and where required to service equipment.
2. Provide at major building and systems sections.
3. Provide chain wheels, guides, and chain loops for valves, where called for or in Mechanical Rooms where valves are mounted higher than 8'-0" AFF.
4. Isolating valves for individual fan convectors, room units, terminal units, or other similar apparatus may be inside cabinet or at connection to branch mains where accessible.
5. Locate valves with handles at horizontal position when 5 ft. or more above the floor, for greater visibility and easier use. Otherwise, locate valves with handles at or above horizontal position. Swing check valves in upright position only.
6. Butterfly valves may be used for water service over 2 in. unless otherwise noted.
7. Ball valves may be used for water service through 3 in., unless otherwise noted.
8. Provide hose threaded valves at low points, strainers, equipment, and as called for.

END OF SECTION

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SECTION 23 05 25
HYDRONIC COIL PIPING PACKAGE

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide Hydronic Coil Piping Packages as shown on drawings and as specified herein.

B. Type, size, and rating compatible with intended service.

C. Suitable for use in Chilled Water and Hot Water Systems.

1.02 SUBMITTALS

A. Submittals shall include the following:

1. Drawing of coil package showing product arrangement with end connection type and size listed. Components shall be clearly labeled.
2. Written description of all components provided in package.
3. Manufacturer's system component specifications.
4. Computer generated, job specific package schedule indicating package part number, end connection size and types, control valve Cv, flow cartridge spring range, design flow rate, and location tag for each coil package.

1.03 DELIVERY, STORAGE, AND HANDLING

A. All equipment provided under this specification shall be shipped to the job site clearly labeled for intended use and in shrink-wrapped plastic per coil assembly. Manufacturer shall factory mount actuators (supplied by others) to actuated ball valve prior to shrink-wrap and shipment.

B. Manufacturer's representative shall coordinate with valve actuator supplier to develop common schedule of actuator type, size, and location. This schedule will be used by coil piping package factory to mount actuators prior to shrink-wrap and shipping.

1.04 WARRANTY

A. Manufacturer shall warrant all components for eighteen (18) months from date of final acceptance. The flow limiting cartridge shall be warranted by manufacturer for no less than five (5) years from date of final acceptance.

B. Manufacturer shall provide replacement flow limiting cartridges at no charge for up to 10% of total quantity of purchased packages in the event that flow conditions (gpm) are modified by Engineer after packages have shipped to the jobsite.

1.05 ACCEPTABLE MANUFACTURER

A. Griswold "Automizer" CPP-2A (Basis of Design).

B. Griswold PIC-V.

C. Delta Controls "Auto Touch".

D. FCI - Delta P Valve.

E. Danfoss/Nexus Coil Pak

F. Flow Design/IMI

**PART 2 - PRODUCTS**

2.01 COMBINATION VALVES (RETURN SIDE) 10 GPM AND BELOW

A. Combination valve shall include a flow limiting cartridge, actuated ball valve, and manual isolation ball in a single valve housing to prevent opportunity for leakage with union end connection. Separate assembled components shall not be acceptable.

B. Valve housing shall consist of forged brass, rated at no less than 360 psi at 250°F.

C. Valve shall have a union end connection that includes a factory installed manual air vent to allow for venting of the coil or heat pump.

D. Automatic Flow Limiting Cartridge (FLC):

1. FLC shall automatically control flow rates with ±5% accuracy over an operating pressure differential range of at least 14 times the minimum required for control. Three (3) operating pressure ranges shall be available with the minimum range requiring no more than 2 PSID to actuate the mechanism.
2. Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring. Plated steel cartridges shall not be acceptable.
3. Dual pressure/temperature test valves for verifying the pressure differential across the cartridge and system shall be standard.
4. Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance.

E. Actuated Ball Valve:

1. Valve ball shall consist of chemically plated nickel brass.
2. Actuator stem shall be removable/replaceable without removing valve from line.

3. Manufacturer shall be able to provide ball insert to make flow control equal percentage. Insert shall be constructed of a glass-filled polymer.
4. Valve shall have EPDM O-rings behind Reinforced Teflon (PTFE) ball seals to allow for a minimum close-off pressure of 100 psi with 35 in.-lbs. of torque for 1/2 in. to 2 in. sizes.
5. Actuator shall provide minimum torque required for full valve shutoff position.
6. Coordinate specific details of actuator with BMS provider. BMS provider shall ship valve actuator to hydronic coil piping package manufacturer to be factory mounted or mount and wire actuators in the field.

F. Control Valves: All pressure independent valves for individual coil control shall be provided as part of Hydronic Coil Piping/Hose Kit Packages as specified herein. Control valve actuators will be supplied and installed by the Contractor or supplied by the Contractor and shipped to the pressure independent valve manufacturer for factory installation. The Contractor is responsible for wiring and testing the valve actuators.

G. Isolation Ball Valve:
1. Valve shall include a 600 WOG manual isolation ball valve.

2.02 COMBINATION VALVES (RETURN SIDE) LARGER THAN 10 GPM

A. The modulating control valves shall be pressure independent.

B. The pressure independent modulating control valve shall include a pressure compensating cartridge, actuated ball valve, and manual isolation ball in a single valve housing.

C. Valve housing shall consist of forged brass, rated at no less than 360 psi at 250°F.

D. Valve shall have a fixed end or union end connection with factory installed air vent to allow for venting of the coil or heat pump.

E. The control valve shall accurately control the flow from 0 to 100% full rated flow.

F. A flow tag shall be furnished with each valve.

G. A universal mounting plate shall allow installation of actuators meeting the system electrical requirements and valve torque requirements as provided by Belimo, ELO Drive, Honeywell, Invensys, Johnson Controls, KMC, Neptronics, or Siemens.

H. The actuator and plate can be rotated after mounting.

I. Pressure Compensating Cartridge (PCC):

1. PCC shall automatically compensate for pressure changes in valve and shall maintain a constant pressure drop across the flow limiting actuated ball.
2. The operating pressure range shall be available with the minimum range requiring 5.8 PSID to actuate the mechanism.
3. Valve internal control mechanism includes a diaphragm and full travel linear coil spring.
4. Valves shall include an accessible/replaceable cartridge.
5. Dual pressure/temperature test valves for verifying the pressure differential across the cartridge and flow limiting ball shall be standard.

J. Actuated Ball Valve:

1. Valve ball shall consist of chemically plated nickel brass or stainless steel.
2. Actuator stem shall be removable/replaceable without removing valve from line.
3. Manufacturer shall be able to provide ball insert to limit flow to maximum flow rate with ±5% accuracy.
4. Valve shall have EPDM O-rings behind the seals to allow for a minimum close-off pressure of 100 psi with 35 in.-lbs. of torque for 1/2 in. to 2 in. sizes.
5. Actuator shall provide minimum torque required for full valve shutoff position.

K. Isolation Ball Valve:

1. Valve shall include a 600 WOG manual isolation ball valve.

2.03 COMBINATION VALVE (SUPPLY SIDE)

A. Combination valve shall include a manual isolation ball and integrated strainer, including drain valve with 3/4 in. hose connection with cap, in a single valve housing to prevent opportunity for leakage. Separate assembled components shall not be acceptable. Dual pressure/temperature test valve shall be standard.

B. Valve housing shall consist of forged brass rated at no less than 360 psi at 250°F.

C. Valve shall have one (1) fixed end and one (1) union end connection.

D. Integrated Strainer:

1. Shall be 20 mesh stainless steel and can be removed from housing without disturbing pipe connections for inspection or replacement.
2. Drain valve shall consist of nickel-plated ball in a brass housing rated for 275 psi at 250°F.

E. Isolation Ball Valve:

1. Valve shall include a 600 WOG manual isolation ball valve.

2.04 SUPPLY/RETURN HOSES (AS REQUIRED)

A. All hoses shall be equipped with swivel end connections at terminal unit. All end connections shall be crimped to meet standard pressure ratings. Serrated/slip fit connections shall not be acceptable.

B. Flame Retardant Hoses:

1. Hose material shall be stainless steel braided over a synthetic polymer liner.
2. Hoses shall meet or exceed the ASTM D380-00 standard.
3. Hoses shall meet or exceed flame retardant testing per standards per ANSI/UL 723, NFPA 255, UBC 42-1, and ASTM E84-00.

C. Insulated Hoses:

1. Hose materials shall be high quality polyethylene pipe insulation over a stainless steel braided inner core.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. Install per manufacturer's recommendations and instructions.

END OF SECTION

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SECTION 23 05 30
ROOF CURBS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation of roof curbs as shown in Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230550 - Wind Restraint for HVAC Systems.

1.03 SUBMITTALS

A. Typical detail and schedule for equipment. Details shall include cross-sectional view illustrating clearly the type of curb being submitted, i.e. double wall insulated, with or without cant.

## PART 2 - PRODUCTS

2.01 ROOF CURBS AND PIPE/DUCT/EQUIPMENT SUPPORTS

A. Basis of Design: Subject to compliance with requirements of this section, provide Roof Products and Systems Corp. (RPS) or comparable product by one of the following:

1. RPI (Roof Products Inc.)
2. ThyCurb
3. Greenheck

B. Configuration: Coordinate curb type with roof deck construction and insulation thickness.

1. Self-flashing without cant strip, with mounting flange (RPS Series 2A).
2. Built-in cant and mounting flange (RPS Series 3A).
3. Built-in raised cant and mounting flange (RPS Series 4A).

C. Provide wind restraint as called for in Item 1.2 above.

2.02 FAN CURBS/DUCT CURBS

A. Double wall, 1-1/2 in. minimum thickness, fully insulated in the interior cavity with rigid insulation. Curb constructed of galvanized steel, 1-1/2 in. 3# density insulation with continuous welded corner seams and painted at all welds. 20 gauge up to 36 in., 18 gauge 38 to 72 in., 16 gauge over 72 in. in any dimension.

B. Kitchen exhaust fan curbs shall be 24 in. high with hinges and service hold-open chain or cable; all other fan curbs shall be 18 in. high or as otherwise noted on the drawings.

C. Provide curb with adhesive backed closed cell foam gasket on the top edge to make airtight seal between curb and ventilator, fan, or air handling unit. Gasketing for kitchen exhaust fan curbs shall be woven ceramic gasket tape rated for the operating temperature.

D. Options:

1. Pitch Mounting: Manufacture curb for roof slopes.

E. Basis of Design: RPS - RC Roof Curbs.

2.03 EQUIPMENT RAILS

A. Double wall, minimum 18 in. high. Constructed of 18 gauge galvanized steel with continuous welded corner seams and painted at all welds. Constructed of heavier gauge steel where standard rail cannot support unit weight. Provide with top cap counter flashing.

B. Basis of Design: RPS - Equipment Rail ER2.

2.04 DUCT MOUNTING PEDESTAL

A. Double wall, minimum 18 in. high. Constructed of 18 gauge galvanized steel with continuous welded corner seams and painted at all welds. Constructed of heavier gauge steel where standard curb cannot support unit weight. Provide with top cap counter flashing.

B. Duct mounting pedestal shall consist of a support rail 12 in. longer than the duct width for single duct support, with a single galvanized steel slide channel equal in length to the equipment rail attached to galvanized steel "U" shaped mounting brackets secured to the side of the equipment rail with lag bolts. The duct mounting slide assembly shall be sized to suit the duct supported and fabricated of galvanized steel and shall have galvanized 18 in. long continuous threaded rods to allow 12 in. vertical adjustment, and lateral adjust spacer bracket for 12 in. horizontal adjustment.

C. Basis of Design: RPS - Duct Mounting Pedestal.

2.05 PIPE MOUNTING PEDESTAL

A. Same construction as "Equipment Rails". Provide with full length steel bracket, U bolts and accessories as required to secure piping to the pipe support as detailed on Contract Drawings.

B. Basis of Design: RPS - Pipe Mounting Pedestal Model ER.

2.06 PIPE CURB ASSEMBLY - PIPE PORTAL

A. Fully insulated with rigid 1-1/2 in. 3# density insulation. Minimum 18 in. high. Constructed of 18-gauge galvanized steel with welded at all contact points. Painted at all welds.

B. Acrylic coated ABS rib reinforced curb cover and integral counter flashing, size and number of pipe and conduit openings as required to suit job conditions.

C. EPDM protective rubber pipe boots and stainless steel clamps secured around each pipe individually. Curb provided with raised cant, flanged or recessed. Curb flange shall suit roof construction and type of insulation being applied.

D. Basis of Design: RPS - Pipe Portal Flashing System.

## PART 3 - EXECUTION

3.01 GENERAL

A. Height as recommended by equipment manufacturer, not less than described in this specification. This Contractor shall be responsible for exact size, length, and location and shall set and secure each curb to the roof. Shim and level curb as required. Provide curb and supports for all roof-mounted equipment. All roof penetrations shall be made through an appropriate curb. All roof mounted equipment including fans, air handling units, etc, shall be set on an equipment support unless otherwise noted. Refer to Contract Drawings for details on plenums extending from curbs.

END OF SECTION

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SECTION 23 05 48
VIBRATION ISOLATION OF MECHANICAL SYSTEMS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.02 RELATED SECTIONS

A. See Specification Section 230550 - Wind Restraint for Mechanical Systems.

1.03 MATERIAL AND EQUIPMENT

A. All vibration isolation mounts shall be supplied by one of the following approved manufacturers:

1. Mason Industries Inc. (Hauppauge, NY) M.I.
2. Kinetics Noise Control Inc. (Dublin, OH) K.N.C.
3. Vibration Mountings & Controls Group. (Butler, NJ) VMC Group
4. Vibration Eliminator Co. (Long Island City, NY) V.E.C.

1.04 QUALITY ASSURANCE

A. Coordinate the size, location and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.

C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein even if not expressly specified or shown on the Drawings, without claim for additional payment.

D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specification.

E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for re-balancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

F. Upon completion of work, the Architect or the Architect's Representative shall inspect the installation and shall inform the contractor of any further work that

must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.

1.05 SUBMITTALS

A. Refer to related sections elsewhere for procedural instruction for submittals.

B. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be completed when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.

C. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.

D. Detailed selection data for each vibration isolator supporting equipment, including:

1. The equipment identification mark.
2. The isolator type.
3. The actual load.
4. The static deflection expected under the actual load.
5. The specified minimum static deflection.
6. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
7. Special details necessary to convey complete understanding of the work to be performed.

E. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job if requested. All costs associated with submission of samples shall be borne by the Contractor.

## PART 2 - PRODUCTS

2.01 VIBRATION ISOLATOR TYPES

A. General:

1. All springs installed out-of-doors shall be zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.

3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.

4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the Drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type FSN (Floor Spring and Neoprene):

1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, grommets shall be provided for each bolt hole in the base plate. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NO isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, beating plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

2. Type FSN isolators shall be one of the following products with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

| | | |
|---|---|---|
| a. | Type SLF | M.I. |
| b. | Type FDS | K.N.C. |
| c. | Series A | VMC Group |

C. Type FSNTL (Floor Spring and Neoprene Travel Limited):

1. Spring isolators shall be freestanding and laterally stable. Spring diameter shall not be less than 0.8 of the compression height of the spring at the

rated load. Spring shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one (1). All mounts shall have leveling bolts. All mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4 in. shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.

2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is use, grommets shall be provided for each bolt hole in the base plate.

3. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

4. Type FSNTL isolators shall be one of the following products, with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

| | | |
|---|---|---|
| a. | Type SLR | M.I. |
| b. | Type FLS | K.N.C. |
| c. | Series AWR | VMC Group |

D. Type FN (Floor Neoprene):

1. Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.

2. Type FN isolators shall be one of the following products or approved equal:

| | | |
|---|---|---|
| a. | Type ND | M.I. |
| b. | Type RD | K.N.C. |
| c. | Series RD | VMC Group |

E. Type NP (Neoprene Pad):

1. Neoprene pad isolators shall be one layer of 1/4 in. to 3/8 in. thick ribbed or waffled neoprene. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

2. Type NP isolators shall be one of the following products or approved equal:

   a. Type W M.I.

   b. Type NPS K.N.C.

   c. Series Shear Flex VMC Group

F. Type DNP (Double Neoprene Pad):

1. Neoprene pad isolators shall be formed by two layers of 1/4 in. to 3/8 in. thick ribbed or waffled neoprene, separated by a galvanized steel, stainless steel or aluminum plate. If the isolator is outdoors, the plate shall not be made of galvanized steel. These layers shall be permanently adhered together. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

2. Type DNP isolators shall be formed from one of the following products or approved equal:

   a. Type WSW M.I.

   b. Type NPS K.N.C.

   c. Series Shear Flex VMC Group

G. Type HSN (Hanger Spring and Neoprene):

1. Vibration isolator hangers shall consist of a free standing and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and hanger housing lower hole size shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the housing. Alternatively, other provisions shall be made to allow for a 30° arc of movement of the bottom hanger rod without contacting the isolator housing. Spring diameter shall not be less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3 in. minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.

2. Type HSN isolators shall be one of the following products or approved equal:

   a. Type 30N M.I.

   b. Type SRH or SFH K.N.C.

c. Type RSH or RFH VMC Group

H. Type HN (Hanger Neoprene):

1. Vibration isolator hangers shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck brushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing.

2. Type HN isolators shall be one of the following products or approved equal:

a. Type HD M.I.

b. Type RH or FH K.N.C.

c. Type RHD or RFD VMC Group

2.02 EQUIPMENT BASES

A. Type BSF (Base-Steel Frame):

1. Steel base frames shall consist of structural steel section sized, spaced, and connected to form a rigid base which will not twist, rack, deform, or deflect in any manner which will negatively affect the operation of the supported equipment or the vibration isolation mounts. Frames shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame shall be at least 1/10 the longest dimension of the base and not less than 6 in. The base footprint shall be large enough to provide stability for supported equipment.

2. Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

3. Type BSF bases shall be supplied by the isolator manufacturer and shall be one of the following products or approved equal:

a. Type WFSL M.I.

b. Type SFB or SRB K.N.C.

c. Series WFB VMC Group

B. Type BIB (Base-Inertia Base):

1. Concrete inertia bases shall be formed of stone-aggregate concrete (150 lb./cu. ft.) and appropriate steel reinforcing cast between welded or bolted perimeter structural steel channels. Inertia bases shall be built to form a rigid base that will not twist, rack, deform, deflect, or crack in any manner that would negatively affect the operation of the supported equipment or

the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the inertia base and not less than 6 in. The base footprint shall be large enough to provide stability for supported equipment. Inertia bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

2. The steel frame and reinforcement shall be supplied by the vibration isolator manufacturer.

3. Frame and reinforcement for Type BIB bases shall be one of the following products or approved equal:

   a. Type KSL M.I.

   b. Type CIB-L or CIB-H K.N.C.

   c. Series WPF VMC Group

2.03 RESILIENT PENETRATION SLEEVE/SEAL

A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is 1/2 in. to 3/4 in. larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend 1 in. beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4 in. of the ends of the sleeve. The remaining 1/4 in. space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Refer to details on Drawings.

2.04 RESILIENT LATERAL SUPPORTS

A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN that are specifically designed to provide resilient lateral bracing of ducts or pipe.

B. Resilient lateral supports shall be one of the following products or approved equal:

   1. Type ADA M.I.

   2. Type RGN K.N.C.

   3. Type MDPA VMC Group

## 2.05 FLEXIBLE DUCT CONNECTIONS

A. Flexible duct connections shall be heavy glass fabric, double neoprene coated, approximately 30 oz. per sq. yd. The clear space between connected parts shall be a minimum of 3 in. and the connection shall have a minimum of 1.5 in. of slack material. Materials for flex connection shall be fire retardant, water and milder resistant, and comply with UL standard 214.

B. Flexible duct connections shall be one of the following products or approved equal:

1. Ventfabrics, Inc. "Ventglass".
2. Ductmate Dyne Corp. "DDFDC".
3. Ductmate "Pro Flex".

## 2.06 FLEXIBLE PIPE AND PUMP CONNECTIONS (BRAIDED STAINLESS STEEL)

A. Braided stainless steel pump and pipe connector(s) shall be constructed of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s) and a stainless steel ring-ferrule/band (material gauge not less than .048 in.) shall be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. Fittings shall be attached using a 100% circumferential TIG weld.

B. Braided stainless steel pump and pipe connector(s) must be suitable for operating temperatures up to 850°F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor.

C. Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

D. Braided stainless steel connectors shall carry a three (3) year warranty when installed in accordance with all specifications and installation instructions as described by the manufacturer.

E. End fittings shall be flat-faceplate steel flanges with 150# ANSI drilling, and outside diameter, carbon steel MPT ends, flanged by Schedule 40 grooved ends or increasing ends.

F. Acceptable Manufacturers: Flexhose Pumpsaver or equivalent Keflex, Metraflex, Mason-Mercer.

## 2.07 THRUST RESTRAINTS

A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be pre-compressed at the factory to allow for a maximum of 1/4 in. movement during starting or stopping of the equipment. Allowable movement shall be field-

adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods.

B. Thrust restraints shall be one of the following products or an approved equal:

1. Type WB M.I.
2. Type HSR K.N.C.
3. Type HTR VMC Group

2.08 GROMMETS

A. Grommets shall be specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range.

B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an approved equal:

1. Type Isogrommets MBIS, Inc. (Bedford Heights, OH)
2. Type WB Barry Controls (Brighton, MA)
3. Type HG Mason Industries Inc., (Hauppauge, NY)

2.09 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

| | | |
|---|---|---|
| 1. | Acoustical sealant | D.A.P. |
| 2. | BR-96 | Pecora |
| 3. | Acoustical sealant | Tremco |
| 4. | Acoustical sealant | U.S.G. |

## PART 3 - EXECUTION

3.01 APPLICATION

A. General:

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the Drawings or specified herein.
2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment:

1. Unless otherwise shown or specified on Drawings, all floor-mounted major equipment shall be set on 6 in. high concrete housekeeping pads.
2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as specified hereunder.
3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the Drawings.
4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment and as indicated on Drawings in the positions shown on the Drawings.
5. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.
6. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4 in. or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Equipment Vibration Isolation Schedule:

| TYPE | VIBRATION ISOLATOR TYPE | MINIMUM STATIC DEFLECTION (In.) | EQUIPMENT BASE |
|---|---|---|---|
| Air Handling Units | FSN | 2.5 | BSF |
| Inline Pumps | HSN | .75 | ---- |
| Boilers | DNP | NA | ---- |
| Inline Fans | HSN | 1.5 | ---- |

*<u>NOTE 1</u>: Equipment base and vibration isolators can be deleted where pumps are provided on slabs on grade and if pumps are placed on concrete inertia slab isolated from surrounding floor slab.*

D. Miscellaneous Mechanical Equipment:

1. Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks and expansion tanks which are connected to isolated piping systems shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for .01 in. static deflection) unless their position in the piping system requires a higher degree of isolation as called for under "Pipe Isolation".

E. Pipes:

1. All chilled water, condenser water, hot water, steam main and engine exhaust piping shall be isolated from the building structure within the following limits:

   a. Within mechanical rooms.

   b. Within 50 ft. total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.).

   c. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.

   d. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2 in., Type FSN or Type HSN isolators shall be used. When the required static deflection is less than or equal to 1/2 in., Type FN or Type HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or Type HN achieving at least 1/4 in. static deflection.

   e. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.

   f. Pipes penetrating the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

   g. Provide flexible pipe connections as called for under "Major Equipment" above and wherever shown on the Drawings.

## 3.02 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General:

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.

2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators:

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of

gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.

4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.
5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beams and joists. Provide suitable intermediate support members as necessary.
6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
7. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and un-isolated pipes on the same trapeze.
8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
10. The installed and operating heights of equipment vibration-isolated with Type FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4 in. clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases:

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitable rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements, and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
2. Unless otherwise indicated, there is to be a minimum operating clearance of 1 in. between steel rails, steel frame base or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to

ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Flexible Duct Connections:

1. Sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so that the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections:

1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.

F. Thrust Restraints:

1. Thrust restraints shall be attached on each side of the fan at the vertical centerline of thrust. The two rods of the thrust restraints shall be parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets:

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals:

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION

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SECTION 23 05 50
WIND RESTRAINT FOR HVAC SYSTEMS

## PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and brace mechanical and electrical systems, as called for, to resist directional wind forces (lateral, longitudinal and vertical).

1.02 APPLICABLE CODES AND STANDARDS

A. Provide work in compliance with the following codes and standards:

B. 2015 International Building Code (Section 1609).

C. 2015 International Mechanical Code (Section 301, Item 301.15).

D. American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures with Supplement No. 1 - Standard ASCE/SEI 7-10.

1.03 QUALITY ASSURANCE

A. General:

1. The contractor shall provide professional engineer stamped and signed calculations, and details of wind restraint systems to meet total design lateral force requirements for support and restraint of mechanical and electrical systems.
2. Systems requiring wind restraint including, but not limited to:
   a. Exhaust fans.
   b. Hooded intake or relief ventilators.
   c. Condensing units.
   d. Ductwork.
   e. Piping.
   f. Boiler flues.
   g. Roof curbs and pipe/duct/equipment supports associated with any of the equipment listed above.

1.04 SUBMITTALS

A. Submit wind force level (Fp) calculations from applicable building code. Submit pre-approved restraint selections, installation details, and plans indicating locations of restraints.

B. Calculations, plans, restraint selection, and installation details shall be stamped and signed by a professionally licensed engineer experienced in wind restraint design.

C. Submit manufacturer's product data.

D. For each piece of equipment that requires wind restraint as outlined in this section, include the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchoring provisions.
2. Anchorage: Provide detailed description of equipment anchorage devices on which the calculations are based and their installation requirements. Identify anchor bolts, studs and other mounting devices. Provide information on the size, type and spacing of mounting brackets, holes and other provisions.

E. The Contractor shall provide photographs of the installed roof mounted equipment, showing the fully installed wind restraint anchoring, prior to the roofing material installation, as a formal submittal for verification that the work has been completed.

## PART 2 - PRODUCTS

### 2.01 CODE INFORMATION

A. This project is subject to the wind bracing requirements of the 2015 International Building Code (Section 1609) and American Society of Civil Engineers ASCE/SEI 7-10. The following criteria are applicable to this project:

1. Nominal Design Wind Speed (V) (Per ASCE 7-10): 115 mph.
2. Risk Category (Per ASCE 7-10): II
3. Exposure Category (Per ASCE 7-10): C
4. Height and Exposure Adjustment Coefficient (Per ASCE 7-10): N/A - Building height is less than 60 ft.

### 2.02 WIND BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Design analysis shall include calculated dead loads, wind loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
2. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
3. All wind restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 2.1.

B. Friction from gravity loads shall not be considered resistance to wind forces.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Wind Restraint of Piping:

1. All restraint systems shall be installed in strict accordance with the manufacturer's restraint guidelines and all certified data.
2. Installation of restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.
3. Transverse piping restraints shall be at 40 ft. maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
4. Longitudinal restraints shall be at 80 ft. maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
5. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24 in. of the elbow or tee or combined stresses are within allowable limits at longer distances.
6. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints.
7. Branch lines may not be used to restrain main lines.
8. Provide reinforced clevis bolts when required.
9. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.
10. Do not brace a system to two independent structures such as roof and wall.

B. Wind Restraint of Electrical Services:

1. All restraint systems shall be installed in strict accordance with the manufacturer's restraint guidelines manual and all certified data.
2. Installation of restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.
3. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
4. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.

5. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
6. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult Structural Engineer of record.
7. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The Contractor shall submit loads to the structural engineer of record for approval in this event.
8. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
9. Provide reinforced clevis bolts where required.
10. Do not brace a system to two independent structures such as a roof and wall.

C. Wind Restraint of Ductwork and Equipment:

1. All restraint systems shall be installed in strict accordance with the manufacturer's restraint guidelines and all certified submittal data.
2. The interaction between mechanical and electrical equipment and the supporting structures shall be designed into the restraint systems.
3. Friction clips shall not be used for anchorage attachments.
4. Expansion anchors shall not be used for non-vibration isolated equipment rated over 10 HP.
5. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction and vertical restraints shall be provided to resist overturning.
6. Installation of restraints shall not cause any change in position of equipment or ductwork, resulting in stresses or misalignment.
7. Exhaust fans with hinge kits shall have wind restraint fasteners installed on the hinged side, same as the three (3) non-hinged sides.
8. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
9. Do not install any equipment or duct that makes rigid connections with the building unless isolation is not specified.
10. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
11. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult Structural Engineer of record.

12. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The Contractor shall submit loads to the Structural Engineer of record for approval in this event.
13. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
14. Provide reinforced clevis bolts where required.
15. Do not brace a system to two independent structures such as a roof and wall.

END OF SECTION

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SECTION 23 05 53
MECHANICAL IDENTIFICATION

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 QUALIFICATION

A. All identification devices shall comply with ANSI/ASME A13.1 for lettering size, length of color field, colors and viewing angles.

1.03 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. (minimum) indicating valve number, location, and valve function. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

1.04 MAKES

A. Allen Systems, Inc.; Brady (W.H.) Co.; Signmark Div.; Industrial Safety Supply Co., Inc.; Seton Name Plate Corp.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where this is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.02 PIPING IDENTIFICATION

A. Identification Types:

1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI/ASME A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

| O.D. Pipe or Covering | Letter Size |
|---|---|
| 3/4 in., 1 in., 1-1/4 in. | 1/2 in. |
| 1-1/2 in., 2 in. | 3/4 in. |
| 2-1/2 in. and over | 1 in. |

B. Lettering:

1. Piping labeling shall conform to the following list:

| Pipe Function | Identification |
|---|---|
| Cold Water | CW |
| Refrigerant Suction | RS |
| Refrigerant Liquid | RL |
| Glycol Supply | GS |
| Glycol Return | GR |

2.03 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high numerals. Identify between heating and plumbing services with 1/4 in. letters above the valve number. Lettering to be stamped and in-filled black. Seton, or equal.

   a. Valve-tag Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Chart:

1. Provide valve chart for all valves tagged as a part of this project. Frame and place under clear glass. Hang in Mechanical Room.
2. Valve chart to include as a minimum, valve #, valve size, valve type, valve service description, valve location.

2.04 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, phenolic (micarta) labels for mechanical engraving, 1/16 in. thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.

3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 in. by 3/4 in.
6. Minimum Letter Size: 1/4 in. for name of units if viewing distance is less than 24 in., 1/2 in. for viewing distances up to 72 in., and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 in. x 11 in. bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

D. Provide for the following equipment:
1. Air handling units
2. Pumps
3. Air Cooled Condenser
4. Boilers
5. H&V units
6. Energy recovery coil
7. Fans

## 2.05 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid. Color coded. Provide for the following:
1. Fire dampers/smoke dampers - RED
2. Plumbing valves - BLUE
3. HVAC valves - ORANGE
4. VAV boxes or reheat coils - GREEN
5. Fans - YELLOW
6. Pumps - BLACK

## PART 3 - EXECUTION

3.01 GENERAL

A. Provide valve tags for all valves provided on project, except for service valves at terminal equipment.

B. Provide equipment tags for all equipment listed above.

C. Provide above ceiling equipment locator stickers on ceiling grid for all equipment listed above.

D. Provide piping identification with directional flow arrows for all piping on project, at maximum intervals of 20 ft. For piping installed through rooms, provide at least one pipe label in each room, for each pipe function.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

B. This Section specifies the requirements and procedures of, mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

C. Test, adjust, and balance the following mechanical systems:

1. Supply air systems, all pressure ranges; including constant volume and variable volume systems.
2. Return air systems.
3. Exhaust air systems; including kitchen exhaust systems.
4. Hydronic systems; including constant flow and variable flow systems.
5. Laboratory Fume Hoods.

D. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes;
2. Specifications for materials for patching mechanical systems;
3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
4. Requirements and procedures for piping and ductwork systems leakage tests.

1.02 SUBMITTALS

A. Provide information in report form listing items required by specifications. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.

B. Strategies and Procedures Plan: Within thirty (30) days of Contractor's Notice to Proceed, submit testing and balancing strategies and step-by-step procedures as specified in Section 3.1.B, "Preparation", and consistent with those listed in Part 3 of this specification.

C. System Readiness Checklists: Within thirty (30) days of Contractor's Notice to Proceed, AABC agency shall provide system readiness checklists as specified in

Section 3.1.C, "Preparation", to be used and filled out by the installing contractors verifying that systems are ready for Testing and Balancing.

D. Examination Report: Provide a summary report of the examination review required in Section 3.1.D to the Engineer, documenting issues that may preclude the proper testing and balancing of the systems.

E. Certified report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.
2. Individual test sheets for air handlers, terminal units, air distribution, exhaust fans, duct traverses, pumps, air handling coils, reheat coils, radiation, convectors, cabinet unit heaters and unit ventilators.
3. Manufacturer's pump and fan curves for equipment installed with design and actual operating conditions indicated.
4. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".

1.03 DEFINITIONS

A. System testing, adjusting and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air and water distribution;
2. Adjustment of total system to provide design quantities;
3. Electrical measurement;
4. Verification of performance of all equipment and automatic controls.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. This data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return supply or outside air inlets or outlets on terminals such as registers, grilles, diffusers, and louvers.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch Main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.04 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
2. Individual manufacturer requirements and recommendations.

B. Maintain qualified personnel at project for system operation and trouble shooting. Contractor shall change sheaves and perform mechanical adjustments in conjunction with balancing procedure.

C. Contractor shall be current member of AABC or NEBB.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the *AABC National Standards for Total System Balance.*

1.05 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balance facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.
2. Prior to balancing, adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary filters and strainers.
3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.
4. All outdoor conditions (Db, Wb, and a description of the weather conditions) at the time of testing shall be documented in the report.
5. Provide sheaves and belts as required to meet system performance requirements for all belt-driven fan motors 10 HP and greater. Adjust and

align sheaves to obtain proper settings and operation. Verify motors are not overloading.

6. Contractor shall replace balancing cocks, flow balancers and dampers in new systems that cannot be manipulated to satisfy balancing requirements.
7. Identify flow balancers, balancing cocks and dampers in existing systems that cannot be manipulated to satisfy balancing requirements.
8. Traverse main ducts to determine total system air quantities after all outlets have been set prior to final adjustment if the system does not meet design requirements. A sum of room CFM's is not acceptable.
9. If duct construction and/or installation prohibits proper traverse readings, provide coil measurements at main coils and/or fresh air intake traverse with units operating in 100% outside air mode (where applicable).

1.06 CONTRACTOR RESPONSIBILITIES

A. Provide Testing and Balancing agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats.

B. Contractor shall provide required BAS hardware, software, personnel and assistance to Testing and Balancing agency as required to balance the systems. Contractor shall also provide trending report to demonstrate that systems are complete.

C. Coordinate meetings and assistance from suppliers and contractors as required by Testing and Balancing agency.

D. Provide additional valves, dampers, sheaves and belts as required by Testing and Balancing agency.

E. Flag all manual volume dampers with fluorescent or other high-visibility tape.

F. Provide access to all dampers, valves, test ports, nameplates and other appurtenances as required by Testing and Balancing agency.

G. Contractor shall replace or repair insulation as required by Testing and Balancing agency.

H. Have the HVAC systems at complete operational readiness for Testing and Balancing to begin. As a minimum verify the following:

1. Airside:
   a. All ductwork is complete with all terminals installed.
   b. All volume, smoke and fire dampers are open and functional.
   c. Clean filters are installed.
   d. All fans are operating, free of vibration, and rotating in correct direction.
   e. ASD start-up is complete and all safeties are verified.

f. System readiness checklists are completed and returned to Testing and Balancing agency.

2. Hydronics:

a. Piping is complete with all 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. All shutoff and balance valves have been verified to be 100% open.

g. Pumps are started, and proper rotation is verified.

h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.

i. ASD start-up is complete and all safeties have been verified.

j. System readiness checklists are completed and returned to Testing and Balancing agency.

I. Promptly correct deficiencies identified during Testing and Balancing.

J. Maintain a construction schedule that allows the Testing and Balancing agency to complete work prior to occupancy.

## PART 2 - PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, Pitot tubes, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required.

B. Instrumentation Calibration: Calibrate instruments at least every six (6) months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Examine Bid Documents and submittals and notify Owner's Representative and Engineer of any questions regarding balancing.

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper Testing and Balancing of systems and equipment.

2. Examine the approved submittals for HVAC systems and equipment.
3. Examine equipment performance data including fan and pump curves.

B. Prepare a Testing and Balancing Strategies and Procedures Plan that includes:
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.

C. Prepare system-readiness checklists, as described in the *AABC National Standards for Total System Balance*, for use by contractor in verifying system readiness for Testing and Balancing. These shall include, at a minimum:
1. Airside:
   a. All ductwork is complete with all terminals installed.
   b. All volume, smoke and fire dampers are open and functional.
   c. Clean filters are installed.
   d. All fans are operating, free of vibration, and rotating in correct direction.
   e. Permanent electrical power wiring and ASD start-up is complete and all 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.
   j. Equipment and duct access doors are securely closed.
2. Hydronics:
   a. Piping is complete with all 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. All shutoff and balance valves have been verified to be 100% open.
   g. Pumps are started and proper rotation is verified.
   h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
   i. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.

j. Suitable access to balancing devices and equipment is provided.

D. Examine construction and notify Owner's Representative and Engineer of outstanding issues related to balancing, as part of "Examination Report" submittal.

1. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.
2. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.
3. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the contractor and functioning.
4. Examine strainers to verify that Contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
5. Examine two-way valves for proper installation and function.
6. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
7. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
8. Examine air vents to verify that contractor has removed all air from all hydronic systems.
9. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, weld-o-lets, and manual volume dampers prior to pressure testing. Note the locations of devices that are not accessible for testing and balancing.

## 3.02 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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve

position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.03 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

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. Check airflow patterns from the outside-air louvers and dampers and the return and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and function.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.04 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 fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.

a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to sheaves sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. 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 modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.05 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outside-air dampers at minimum, and return-and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
   a. If air outlets are out of balance at minimum airflow, report the conditions but leave outlets balanced for maximum airflow.
6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that the adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

## 3.06 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Cross check the summation of required coil and heat exchanger gpms with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:

1. Check liquid level in expansion tank and verify that tank is set to specified pressure for system fill and expansion.
2. Check that makeup water has adequate pressure to highest vent.
3. Check that control valves are in their proper positions.
4. Check that air has been purged from the system.
5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
6. Verify that motor starters are equipped with properly sized thermal protection.

## 3.07 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 or fittings.
   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. On single stage centrifugal pumps, 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, if requested by Engineer.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure all final pump operating data, TDH, volts, amps, static profile.
3. Mark all final settings.

G. Verify that all memory stops have been set.

## 3.08 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential pressure (DP) sensor is located per the Contract Documents.
2. Determine if there is diversity in the system.

B. For systems with no diversity:

1. Follow procedures outlined for constant-flow hydronic systems.

2. Prior to verifying final system conditions, determine the system DP setpoint.
3. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.
4. Mark all final settings and verify that all memory stops have been set.

C. For systems with diversity:
1. Determine diversity factor.
2. Simulate system diversity by closing required number of control valves, as approved by the design Engineer.
3. Follow procedures outlined for constant flow hydronic systems.
4. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance the terminals that were just opened.
5. Prior to verifying final system conditions, determine the system DP setpoint.
6. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.
7. Mark all final settings and verify that all memory stops have been set.

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.

## 3.09 PROCEDURES FOR LABORATORY FUME HOODS

A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate make-up air is available to achieve the indicated flow of the hood.

B. Measure, adjust and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.
1. For laboratory fume hoods installed in variable exhaust systems, measure adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.
2. For laboratory fume hoods designed with integral make-up air, measure, adjust, and record the exhaust and make-up airflow.

C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.

D. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.

2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 in. between points and between any point and the perimeter of the opening.

   a. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.

   b. Calculate and report the average face velocity by averaging all velocity measurements.

   c. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.

   d. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

3. Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.

E. With the room and laboratory fume hoods operating at indicated conditions all fume hoods installed shall be tested to current ASHRAE 110 Standard. Field test reports must be performed and prepared by an independent third party organization having no affiliation with the manufacturer. Results must indicate tracer gas performance ratings of 4.0 AI 0.05 or better for all tests. Manufacturer must have a representative on-site for all tests and must assist in trouble-shooting and correcting all non-conforming hoods.

F. Person-as-Mannequin Test: This test is intended to simulate real-world laboratory conditions in which a real person manipulates real objects in the hood. This test is performed with the investigator standing in front of the ejector while repeatedly moving five (5) objects from one side of the ejector to the other, then rotating the body away from the hood with the elbows next to the body and the arms horizontal in front. This series of movements is repeated for the duration of the tracer gas test. The air sampling is performed with a sampling probe at the same

height as the breathing zone of the mannequin. Results must indicate tracer gas performance ratings of 4.0 AI 0.10 or better for all tests.

G. Contractor to provide a complete report of the results of the testing program including an executive summary, an outline of the test procedures and equipment used, a table of the results of each test conducted on each hood and a conclusion and recommendation section discussing the results and (if necessary) recommendations to improve fume hood performance.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Zero to plus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Minimum Outside Air: Zero to plus 10 percent.
4. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.
5. Heating-Water Flow Rate: Plus or minus 10 percent.
6. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.11 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 Testing and Balancing 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 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 or NEBB 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. Certification Statement.

l. Name, Signature, and Certification Number.

2. Table of Contents.

3. 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

C. Required air side data - Test, adjust and record the following:

1. Motors:

a. RPM

b. BHP

c. Full load amps

d. Sheave sizes, number and size of belts

e. Shaft diameter

f. Complete nameplate data

2. Fans:

a. Cfm

b. RPM

c. Suction static pressure

d. Discharge static pressure

e. Sheave sizes, number and size of belts, key sizes, shaft, diameter

f. Complete nameplate data

g. Sketch of system's inlet and outlet connections

h. Location of test port

3. Duct: Traverse Zones

a. Cfm

b. Static Pressure

4. AHU - Fan coil units (In both minimum O.A. and economizer modes):

a. Minimum outdoor air Cfm

b. Total discharge and return Cfm

c. Static profile thru unit

d. Complete nameplate data

5. Coil:

a. Entering air temperature (DB/WB)

b. Leaving air temperature (DB/WB)

c. Static differential

d. Face velocity and area

e. Cfm

f. Complete nameplate data

6. VAV Boxes:

a. Minimum Cfm

b. Maximum Cfm

7. Registers/Grilles/Diffusers:

a. Cfm

b. Set, adjust and record air flow pattern

8. Filter Banks:

a. Nameplate data

b. Static pressure drop

D. Required Fluid Data: Test, adjust and record the following:

1. Heat Transfer Devices: Including, but not limited to air handlers, convectors, fin tube radiation sections, unit ventilators, fan coils, cabinet heaters, unit heaters, heat pumps, heat exchangers.

a. GPM (coil and bypass)

b. Entering water temperature

c. Leaving water temperature

d. Water pressure drop

e. Complete nameplate data

f. Refrigerant suction pressure and temperature

2. Pumps:

a. Check rotation

b. GPM

c. Pump off pressures (suction and discharge)

d. Running suction pressure

e. Running discharge pressure

f. Running load amps

g. RPM - motor

h. Complete nameplate motor and pump

i. Marked up pump curve illustrating final operating conditions

3. Boilers:

a. GPM

b. Entering water temperature and pressure

c. Leaving water temperature and pressure

d. Complete nameplate data

E. The final test and balance report shall be provided as a formal project submittal for review by the Engineer of Record.

END OF SECTION

SECTION 23 07 10
INSULATION

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTAL

A. Submit product data, product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 232010 - Piping Systems and Accessories.

B. Section 233100 - Sheet Metal and Ductwork Accessories Construction.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.
2. Insulation, including finishes and adhesives on the exterior surfaces of ducts, pipes, and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84.
3. Asbestos or asbestos bearing materials are prohibited.
4. Comply with 2015 International Energy Conservation Code as amended by Part 1 of the 2017 Supplement to the New York State Energy Conservation Code.
5. All adhesives, coatings and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
6. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.

7. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.02 ACCEPTABLE MANUFACTURERS

A. Fiberglass: Knauf/Manson, Johns Manville, Owen-Corning, Certainteed. (Board, Blanket and Liner).

B. Polyisocyanurate: Dow Trymer 2000XP, HyTherm.

C. Flexible Elastomeric: Armacell, K-Flex.

D. Adhesives, Coatings, Mastics, Sealants: Childers, Foster.

2.03 PIPE INSULATION (RIGID FIBERGLASS TYPE)

A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature installed value. Maximum Service Temperature: 1000°F.

C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Johns Manville Zeston 2000, speedline Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact 20 mil. thick PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures to be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.04 PIPE INSULATION (RIGID POLYISOCYANURATE TYPE)

A. Preformed Rigid Polyisocyanurate Insulation: Cellular foam complying with ASTM C591, rigid molded, non-combustible. 2 lb./ft$^3$ nominal density. Maximum thermal conductivity (k) shall be 0.19 BTU-in/ft$^2$ hr. °F at 75°F mean temperature. Maximum Service Temperature; 300°F.

B. Vapor Retarder Jacket; Dow Saran Vapor Retarder Film and Tape, Polyguard zeroperm film and tape, or Knauf insulation expert FSK.

C. Covering Jacket; White Kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn.

2.05 FLEXIBLE TYPE INSULATION

A. Flexible Elastomeric Thermal Insulation: Closed-cell, foam material. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Maximum thermal conductivity (k) shall be 0.25 BTU-in/$ft^2$ hr. °F at 75°F mean temperature. Adhesive: As recommended by insulation material manufacturer.

B. Insulation shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102, "Method of Test for Surface Burning Characteristics of Building Materials".

2.06 DUCT INSULATION

A. Duct insulation shall have a thermal resistance (R) value identification mark by the manufacturer applied no less than every 10 ft., as per Energy Code requirements.

B. Flexible Fiber Glass Blanket:

1. Product meeting ASTM C 553 Types I, II and III, and ASTM C 1290; Greenguard compliant.
2. 'K' Value of 0.27 at 75°F mean temperature. Maximum Service Temperature (Faced): 250°F.
3. Vapor Retarder Jacket: FSK conforming to ASTM C 1136 Type II.
4. Installation: Maximum allowable compression is 25%. Securement: Secured in place using outward cinching staples in combination with appropriate pressure-sensitive aluminum foil tape.
5. Density: 1.5 PCF. See Exhibit II for the thickness requirement at each density.

C. Rigid Fiber Glass Board:

1. Product meeting ASTM C 612 Type IA and IB.
2. 'K' Value of 0.23 at 75°F mean temperature. Maximum Service Temperature: 450º F.
3. Vapor Retarder Jacket: ASJ conforming to ASTM C 1136 Type I, or FSK or PSK conforming to ASTM C 1136 Type II.
4. Securement: Secured in place using adhesive and mechanical fasteners spaced a minimum of 12 in. on center with a minimum of 2 rows per side of duct. Insulation shall be secured with speed washers and all joints, breaks and punctures sealed with appropriate pressure-sensitive foil tape.
   a. Concealed Areas: Minimum 3 lb./$ft.^3$.
   b. Exposed Areas: 6 lb./$ft.^3$ minimum density for duct less than 8 ft. - 0 in. above finished floor.

D. Polyisocyanurate Board: Closed cell polyisocyanurate core bonded to a triple laminated foil facing on both sides. Comply with ASTM C1289 Type I Class I. "K" value: 0.17 BTU in/(hr. sq.ft. degree F) at 75 deg. F.

2.07 EQUIPMENT INSULATION

A. Rigid Fiber Glass Board:

1. Product meeting ASTM C 612 Type IA and IB.
2. Concealed Areas:
   a. Density: Minimum 3 PCF.
   b. 'K' Value of 0.23 at 75°F mean temperature. Maximum Service Temperature: 450°F.
   c. Vapor Retarder Jacket: ASJ conforming to ASTM C 1136 Type I, or FSK conforming to ASTM C 1136 Type II.
3. Exposed Areas:
   a. Density: Minimum 6 PCF
   b. 'K' Value: ASTM C 177, 0.22 at 75°F mean temperature.

B. Foam Board. Polyisocyanurate core. Foil faced on one side and opposite side faced with white acrylic coated embossed aluminum, 4-mil. equal to "Dow Chemical Thermax Heavy Duty".

2.08 FIELD-APPLIED JACKETS

A. Piping:

1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.
2. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003-alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
3. Stainless-Steel Jacket: ASTM A 666, Type 304 or 316; 0.10 inch thick; and factory cut and rolled to indicated sizes. Moisture Barrier: 3-mil-thick, heat-bonded polyethylene and kraft paper. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.
4. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.
5. Venture Guard Jacketing: 26.6 mil thick, Hypalon self adhesive membrane. Venture Tape Corp. Venture Guard, or equal.

B. Ductwork:

1. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section. Finish: Cross-crimp corrugated or stucco embossed finish. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.

2. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A 666, Type 304 or 316; 0.10 inch thick; and roll stock ready for shop or field cutting and forming to indicated sizes. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

3. Alumaguard Jacketing: Self adhesive, 60 mil thick, rubberized bitumen, foil faced membrane. Polyguard Products, Inc. Alumaguard 60, or equal.

4. Venture Guard Jacketing: 26.6 mil thick, Hypalon self adhesive membrane. Venture Tape Corp. Venture Guard, or equal. To be used on the bottom surface of rectangular ducts greater than 24 in. wide, due to lesser jacket weight that will avoid sagging issues over time.

## 2.09 COATINGS, MASTICS, ADHESIVES AND SEALANTS

A. Vapor Barrier Coatings: Used in conjunction with reinforcing mesh to coat insulation on below ambient services temperatures. Permeance shall be no greater than 0.08 perms at 45 mils dry as tested by ASTM F1249. Foster 30-65 Vapor Fas; Childers CP-24, or approved equal.

B. Lagging Adhesives: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas; Childers CP-50AMV1 Chil Seal, or approved equal.

C. Weather Barrier Mastic: Used outdoors to protect above ambient insulation from weather. Foster 46-50 Weatherite; Childers CP-10 Vi Cryl, or approved equal.

D. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.

E. Elastomeric Insulation Adhesive: Used to bond elastomeric insulation. Foster 85-75; Childers CP-82, or approved equal.

F. Elastomeric Insulation Coating: Water based coating used to protect outside of elastomeric insulation. Foster 30-65, or approved equal.

G. Insulation Joint Sealant: Used as a vapor sealant on below ambient piping with polyisocyanurate and cellular glass insulation. Foster 95-50; Childers CP-76, or approved equal.

H. Metal Jacketing Sealant: Used as a sealant on metal jacketing seams to prevent water entry. Foster 95-44; Childers CP-76, or approved equal.

I. Reinforcing Mesh: Used in conjunction with coatings/mastics to reinforce. Foster Mast A Fab; Childers Chil Glass #10, or approved equal.

2.10 MATERIALS AND SCHEDULES

A. See Exhibits at the end of this section.

**PART 3 - EXECUTION**

3.01 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.

C. All pipe and duct insulation shall be continuous through hangers, walls, ceiling and floor openings, and through sleeves, unless not allowed by Fire Stop System.

D. Provide thermal insulation on clean, dry surfaces and after piping, ductwork and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, air separators, drain valves, etc. must be totally encapsulated with Elastomeric insulation.

F. Items such as boiler manholes, handholds, clean-outs, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personnel injury: Piping from zero to seven feet above all floors and access platforms including hot (above 140°F) piping and any other related hot surface.

H. All pipes shall be individually insulated.

I. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

3.02 PIPE INSULATION

A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed

B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed.

C. Hanger Shields: Refer to Section 232010 "Piping Systems and Accessories".

D. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
2. Field Insulated Type: Provide high density insolating blocks per manufacturers recommended spacing between pipe and shield.
3. Tape shields to insulation.

E. Joints in section pipe covering made as follows:

1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.
3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating. When using polyisocyanurate or cellular glass on below ambient piping/duct, seal all insulation joints with insulation joint sealant.

F. Fittings, Valves and Flanges:

1. Hot Services and Domestic Cold Water: Flexiblefitting insulation of the same material and thickness as the adjacent pipe insulation. Vapor seal domestic cold water with two (2) coats of white vapor barrier coating.

2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.

G. Flexible Pipe Insulation:

1. Split longitudinal joint and seal with adhesive.

2. Fittings made from miter-cut pieces properly sealed with adhesive, or ells may be continuous.

H. For piping exposed to the elements, jacketing shall be aluminum with a factory applied moisture barrier. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2 in. overlap joint. All joints shall be sealed completely along the longitudinal seam and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2 in. wide or a minimum 2 in. overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2 in. and be completely weather sealed. Jacket at ells and tees shall be mitered, or pre-manufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using specified metal jacketing sealant as recommended by the manufacturer.

I. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

J. Apply aluminum jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases. Fittings of aluminum-jacketed piping may be either aluminum or standard PVC fitting covers.

K. All exposed piping less than 8'-0" above finished floor in occupied spaces have a continuous aluminum jacketing.

3.03 DUCTWORK INSULATION

A. Provide external thermal insulation for duct. Not required where ducts have internal acoustical insulation. Make special provisions at dampers, damper motors, thermometers, instruments, and access doors. Apply as follows:

1. Rigid Board Type: Impale board over mechanical fasteners, welded pins or adhered clips, 12 in. to 18 in. centers; minimum of two (2) rows per side. Secure insulation with washer clips. Self-adhesive clips are not acceptable. Staple all joints. Seal breaks and joints in vapor barrier with 4 in. wide matching tape and 4 in. glass-fab applied with specified vapor barrier coating. Apply tape over corner beading where exposed.

2. Flexible Blanket Type: Install Duct Wrap to obtain specified R-value using a maximum compression of 25%. Installed R-value shall be per ECC of NYS. Firmly butt all joints. The longitudinal seam of the vapor retarder must be overlapped a minimum of 2 in. Where vapor retarder performance is required, all penetrations and damage to the facing shall be repaired using pressure-sensitive foil tape, and coated with vapor barrier coating prior to system startup. Pressure-sensitive foil tapes shall be a minimum 3 in. wide and shall be applied with moving pressure using a squeegee or other appropriate sealing tool. Closure shall have a 25/50 Flame Spread/Smoke Developed Rating per UL 723. Duct wrap shall be additionally secured to the bottom of rectangular ductwork over 18 in. wide using mechanical fasteners on 18 in. centers. Self-adhesive clips are not acceptable. Care should be exercised to avoid over-compression of the insulation during installation.

3. Exterior Ductwork: Self Adhering Cover: Membrane shall be a pre-manufactured self adhering product with an UV resistant, embossed facing. Water vapor transmission of the installed product shall be .020 perms or less. Product shall be suitable for continuous use in low temperatures of -10°F. Manufacturers shall be Flex-Clad 400, MFM Building Products Corp. or Alumaguard 60, Polyguard Products, Inc.

## 3.04 EQUIPMENT INSULATION

A. Apply insulation with joints firmly butted as close as possible to the equipment surface. Insulation shall be secured as required with adhesive, mechanical fasteners or banding material. Fasteners shall be located a maximum of 3 in. from each edge and spaced no greater than 12 in. on center.

B. Vapor retarders shall overlap a minimum of 2 in. at all seams and be sealed with appropriate pressure-sensitive tape and vapor barrier coating. All penetrations, facing damage, and mechanical fasteners shall be covered with a minimum 2 in. overlap of tape and vapor barrier coating.

C. Calcium Silicate Equipment Insulation: Secure blocks with galvanized steel bands, 12 in. O.C., then point with insulating cement. Field apply 8 oz. knit fiberglass cloth, cemented and applied over standard jacket. Properly cut at fittings to avoid wrinkles and coat with white mastic coating. Leave ready for painting.

D. Fiberglass Equipment Insulation: Secure fiberglass with pins, studs, or clips. Field apply 8 oz. knit fiberglass cloth, cemented and applied over standard jacket. Properly cut at fittings to avoid wrinkles and coat with white lagging adhesive/coating. Leave ready for painting.

E. Equipment insulation exposed to the elements shall be finished with minimum 0.030 in. thick outdoor weather able PVC, specified weather barrier mastic and glass cloth, or metal. All joints shall be positioned so as to shed water; with a minimum 3 in. overlap, and completely weather sealed.

F. For equipment insulation exposed in mechanical rooms or subject to mechanical abuse, finish with minimum 0.020 in. thick PVC Jacketing or metal. All other insulation shall be finished as appropriate for the location and service or as specified on the drawings.

## EXHIBIT "I" - PIPE INSULATION MATERIALS

| SERVICE | INSULATION MATERIAL | THICKNESS | REMARKS |
|---|---|---|---|
| Hot water and glycol/hot water (200°F and lower) | Glass fiber | 1-1/2 in. and Larger: 2 in.<br>1-1/4 in. and Smaller: 1-1/2 in. | |
| Refrigeration Piping (Suction and liquid lines) | Flexible | 1 in. and Larger: 1 in.<br>3/4 in. and Smaller: 1/2 in. | |
| Outdoor Refrigeration Piping (Suction and liquid lines) | Flexible | 1 in. and Larger: 1 in.<br>3/4 in. and Smaller: 1/2 in. | Insulation shall be provided with a UV resistant coating. |
| Domestic cold water | Glass fiber | 1-1/2 in. and Larger: 1 in.<br>1-1/4 in. and Smaller: 1/2 in. | |
| Outdoor Piping | Polyisocyanurate | Insulate pipe with double the thickness called for above | Cover with Alumaguard jacketing applied per manufacturer's recommendations |
| AHU-1 condensate drains and concealed AC unit condensate drains | Flexible | All Sizes: 1/2 in. | |
| Piping in exterior walls, spaces, overhangs, attics, exterior, or where subject to freezing. | | Insulate pipe with double the thickness called for above | |

## EXHIBIT "II" - DUCT INSULATION MATERIALS

| SERVICE | INSULATION MATERIAL | THICKNESS | REMARKS |
|---|---|---|---|
| HVAC Supply | Within mechanical rooms or exposed at 8 feet or less above finished floor: Rigid fiberglass | ……..……..1-1/2 in. | Min. installed R value of 6 |
| | Concealed: Flexible fiberglass | …….2 in. at 1.5 PCF | Min. installed R value of 6 |
| Supply or Return ducts in cold attic spaces or other un-conditioned spaces | Flexible fiberglass | ……..……..…5 in | Min. installed R value of 12 |
| Exhaust ducts in cold attic spaces or other un-heated spaces | Flexible fiberglass | …….……. 3 in | Min. installed R value of 8 |
| Supply ducts, exposed within the conditioned space served | ……. | …NOT INSULATED… | Does not include the associated supply ductwork within the Mechanical Room or supply duct to the conditioned space. |
| Interior ductwork indicated to be lined | ……. | …NOT INSULATED… | …… |
| Return-air ducts within heated building envelope | ……. | …NOT INSULATED… | …… |
| Air conditioning supply (insulated | …… | EXTERIOR INSULATION NOT REQUIRED | …… |

| SERVICE | INSULATION MATERIAL | THICKNESS | REMARKS |
|---|---|---|---|
| double wall) | | | |
| Neutral ventilation air supply (between 65°F and 80°F) | …….. | … NOT INSULATED … | …… |
| Outside air ducts and plenums, connections and mixing boxes Combustion air ductwork | Rigid fiberglass | …….……. 2 in. | Min. installed R value of 8<br>Provide neat fit at intake plenum |
| Exhaust, relief or vent ducts and plenums | Exposed: Rigid fiberglass | ……...……1-1/2 in. | Min. installed R value of 6 |
| | Concealed: Flexible fiberglass | ……...……2 in. | Insulate 15 ft. from exterior opening and plenums |
| Outdoor Ductwork | Polyisocyanurate board<br>Rigid Fiberglass | ……...……..2-1/2 in.<br>……...……..3 in. | Min. installed R value of 12<br>Cover with Alumaguard jacketing applied per manufacturer's recommendations. |

## EXHIBIT "III" - EQUIPMENT INSULATION MATERIALS

| SERVICE | INSULATION MATERIAL | THICKNESS | REMARKS |
|---|---|---|---|
| Air removal assemblies and fabric filter assemblies | ---------- | SAME AS WATER PIPING | |
| Heating system expansion tanks and chemical feed tanks | ---------- | NOT INSULATED | ---------- |

END OF SECTION

SECTION 23 09 23
BUILDING MANAGEMENT SYSTEM - DDC LOGIC/ELECTRIC ACTUATION

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings. Provide a complete Building Management System (BMS), to perform the functions described in this Section. Provide wiring and conduit required to connect devices furnished as a part of, or accessory to, this automatic control system. Control wiring is defined as wiring up to and including 120 volts. Install wiring in accordance with requirements of "Electrical Wiring" in Section 230504, and the National Electrical Code. Provide all required devices for proper system operation, including special electrical switches, transformers, relays, pushbutton stations, etc.

1. All Actuation of valves and dampers shall be electric unless specifically called out elsewhere in the specifications or drawings.

B. The BMS System shall have the following capabilities as described in these specifications:

1. The network controllers and operator's workstations shall be connected directly to the Owner's Ethernet Network. The network controller shall also contain SNMP for integration to the Owner's Network Controllers System.
2. Offsite access for Owner's personnel shall be provided and shall have full workstation capability from remote location. Identical graphical displays shall be provided for offsite access to match the displays at the on-site Operator's Workstation. Connection to the site shall be via a high speed Ethernet connection.
3. The Network Controller must act directly as the WEB server. It must directly generate the HTML code to the requesting user (i.e. WEB browser), eliminating the need and reliance on any PC-based WEB server hardware or software.
4. The system shall be capable of sending both emails and text messages for alarms. A minimum of six (6) email addresses and cell phone numbers (for text messages) must be supported by the system. Coordinate with the Owner for email addresses, cell numbers and alarms.
5. All system variables in the temperature control system shall be Microsoft variables allowing them to be displayed and manipulated in other Microsoft products.
6. Network controllers shall all be flash upgradeable and not require changing chips for upgrades.

7. Short term logging of historical data shall be provided for every DDC input and output in the system. Each point shall be capable of being logged for a minimum of two (2) weeks.

C. The BMS shall consist of PC-based workstations and microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions. Further, the system shall be the backbone framework for the Security/Card Access/CCTV system through the front-end software.

D. The system shall consist of the following components:

1. Provide one (1) File Server, one (1) Operator Workstation Computer(s), and printer(s) as described in this specification. The Workstations shall be running the standard workstation software developed and tested by the manufacturer of the network controllers and the standalone controllers. No third party front-end workstation software will be acceptable.
2. Provide Ethernet-based network controllers as described in this specification. Controllers shall connect directly to the Operator Workstation over Ethernet, provide communication to the Standalone Digital Control Units and/or other Input/Output Modules and serve as a gateway to equipment furnished by others.
3. Provide the necessary quantity and types of standalone controllers to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each standalone controller shall operate completely standalone, containing all of the I/O and programs to control its associated equipment.
4. A high speed Ethernet connection to the site shall be used for offsite access to the site. Coordinate with the Owner's IT professionals for high speed system access and shall comply with Owner's requirements to maintain the level of security required by the Owner. Coordinate with Owner and provide VPN (Virtual Private Network) as required, to comply with the Owner's IT professionals requirements.
5. BACnet Protocol Integration - BACnet:
   a. The neutral protocol used between systems will be BACnet over Ethernet and comply with ASHRAE BACnet standard 135-2003.
   b. A complete Protocol Implementation Conformance Statement shall be provided for all BACnet system devices.
   c. The ability to command share point object data, change of state data and schedules between the host and BACnet systems shall be provided.

## 1.02 QUALITY ASSURANCE

A. The complete automatic temperature control system shall be comprised of electric control devices with a microprocessor based Direct Digital Control System. All

work shall be installed only by skilled mechanics employed by the BMS Subcontractor.

B. The BMS Subcontractor shall have a minimum of five (5) years' experience in systems of similar size, type and complexity installed within a 100 mile radius.

C. The BMS Subcontractor shall have a local service department (within a 50 mile radius) and have available a minimum of three (3) factory trained technicians within a 24 hour period.

D. All components shall be fully tested and documented to operate as a complete system.

E. Supplier must guarantee that all replacement parts will be carried in stock for a period of ten (10) years minimum from the date that the system is commissioned.

F. Electrical standards: Provide electrical products that comply with the following agency approvals:

1. UL 916; Energy Management Systems for Temperature Control components and ancillary equipment.
2. UL 873; Temperature Indication and Regulating Equipment.
3. FCC, Part 15, Subpart J, Class A Computing Devices.

G. All products shall be labeled with the appropriate approval markings. System installation shall comply with NFPA, NEMA, Local and National codes.

1.03 ACCEPTABLE MAKES

A. The complete Building Management System is designed and based on that manufactured by Automated Logic. Acceptable Make: Andover, Honeywell (based on JACE), Automated Logic, Alertron.

1.04 SUBMITTALS

A. Submit for review, a brochure containing the following:

1. Detailed piping and wiring control diagrams and systems description for each system under control.
2. Detailed layout and nameplate list for component control panels and DDC panels.
3. Submit a valve and damper schedule showing size, pressure drop configuration, capacity, and locations. Provide apparatus bulletins and data sheets for all control system components.
4. A complete listing of input and output points, control loops and/or routines, including time of day functions, and facilities management system functions for each controlled system. This listing shall include point logical names, identifiers, and alarmable ranges.

5. Provide as part of a separate submittal a hard copy of all graphics showing system components, sensor locations, setpoints and fixed/variable data. Engineer shall review and approve graphic format prior to final acceptance of system.

1.05 SCOPE OF WORK

A. Except as otherwise noted, the control system shall consist of all Ethernet Network Controllers, Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, dampers, damper operators and other accessory equipment, along with a complete system of electrical interlocking wiring as required to fill the intent of the specification and provide for a complete and operable system.

B. The BMS Subcontractor 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.

C. All interlocking, wiring and installation of control devices associated with the equipment shall be provided under this Contract. The BMS Subcontractor shall demonstrate the operation of the system to the Owner and prove that it complies with the intent of the drawings and specifications.

D. Provide services and manpower necessary for commissioning of system. Commissioning reports showing the testing of each DDC point on the system shall be submitted to the Engineer for review and approval upon completion of the commissioning process. Refer to the Commissioning Specification Section 230800.

E. Provide owner with full open programing capability. All required software, licenses and passwords shall be provided.

1.06 WORK INCIDENTAL TO TEMPERATURE CONTROL

A. The BMS Subcontractor shall furnish the following materials, installation by the Contractor:

1. For piping work:

a. Control valves in piping.

b. Immersion sensing wells in piping systems.

c. Valved pressure taps.

2. For sheet metal work:

a. All automatic dampers, the BMS Subcontractor shall assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper and motors.

b. The Contractor shall provide access doors or other means of access through ducts or ceilings and walls for service and adjustment of controllers, valves, and dampers.

B. Control manufacturer shall furnish written details, instructions and supervision for the above trades to ensure proper installation size, and location of any equipment furnished for installation by others.

1.07 CONTROL SYSTEM GUARANTEES

A. Guarantee the new control system to be free from defects in material and workmanship, for a period of one (1) year after final acceptance. Guarantee system to:

1. Maintain temperatures within 1°F above and below setting.
2. Humidity devices shall maintain relative humidity conditions within 3% of span 0-100% RH.

B. Provide one (1) year maintenance service of control components, to start concurrently with the guarantee specified above. Such service shall include software updates and 24 hour, 7 day emergency and seasonal inspection and adjustment of operating controls and replacement of parts or instruments found deficient and defective during this period.

C. Provide monitoring of the DDC system as soon as the system is operating and then for a minimum of one (1) year (24 hours/day, 7 days/week) after the acceptance date. A monthly report will be sent to the Owner with a description of general system status and any alarms or off-normal conditions.

D. Guarantee future availability of continuous, 24 hour, 7 day a week service for the systems through available maintenance contracts.

1.08 SYSTEM ADJUSTMENT AND CALIBRATION

A. When the Work has been completed, completely adjust and calibrate the control system. Review the operation of each system input and output, control loops and/or software routings, timing functions, operator entered constants and facilities management functions and observe that they perform their intended functions. Provide a complete values and points log, printed every hour, for one week to demonstrate control functions and programming. Provide one point log for summer operation and one winter. Points to be trended shall be selected by the Engineer. When above procedure has been completed and the control system is operating satisfactorily, submit a letter with one (1) copy of completed values and points log to the Owner's Representative advising them that the control system is 100% complete and operates in accordance with the Contract Documents.

B. After review and approval of points log by the Engineer, the BMS subcontractor shall schedule a technician on site for field review of system components, operation and graphics as part of final system appearance.

1.09 INSTRUCTIONS TO THE OWNER'S REPRESENTATIVE

A. Provide competent control technicians to instruct the Owner's operating personnel and turn over three (3) copies of maintenance manual. Provide a total of 64 hours of instruction at the site, 32 hours during start-up and 32 hours after six (6) months. Instruction sessions shall be scheduled at the Owner's convenience and shall be limited to four (4) hours per session. The instructions shall include, but not be limited to, the following:

1. System Overview.
2. System Software and Operation:
   a. System Access.
   b. Software Features Overview.
   c. Changing Setpoints and Other Attributes.
   d. Scheduling.
   e. Editing Programmed Variables.
   f. Displaying Color Graphics.
   g. Running Reports.
   h. Workstation Maintenance.
   i. Application Programming.
3. Operational sequences including start-up, shutdown, adjusting and balancing.
4. Equipment maintenance.

**PART 2 - PRODUCTS**

2.01 CONTROL DEVICES

A. Control Valves:

1. Sized by BMS Subcontractor and guaranteed to meet the heating and cooling requirements. Water valves shall be sized on the basis of 15% of the total system pressure drop, but not more than 10 ft. of head drop. Steam valves shall be sized for no more than a 5 psig pressure drop, or 30% (max.) of design steam pressure, whichever is smaller. Pressure drop for valves shall be submitted for review, including all CV values.
2. Valves shall be equal percentage type, equipped with characteristic type throttling plug, #316, stainless steel or Monel stem, removable composition discs, and rubber diaphragms. Provide with necessary features to operate in sequence with other valves or damper operators and adjustable throttling range as required by the sequence of operations.

3. Valves in 2 in. and smaller shall be screwed bodies; 2-1/2 in. and larger shall be flanged bodies; designed for 125 psi operating pressure. Arranged to fail-safe as called for; tight closing and quiet operating.

4. Electric Operators:

   a. Provide 24 VAC control operators which are 0-10 VDC input proportional with spring return as needed by control sequence and designed for water service valve bodies. Operator shall be synchronous motor driven with up to 150 in. lb. force and force sensor safety stop.

B. Temperature Sensors:

1. All temperature devices shall use precision thermistors accurate to ± 0.36°F over a range of -30 to 230°F.

2. Standard space sensors shall be provided in an off white, or white, enclosure for mounting on a standard electrical box.

3. Provide manual override of unoccupied mode. Where manual override of unoccupied mode of control is indicated on the drawings or sequence of operation, provide a push button for selecting after hours operation.

4. Provide manual adjustment slider with ± programmable scale. Programmable scale shall have the capability to be limited via the DDC System.

5. Provide a local LCD display for viewing the space temperature.

6. Duct temperature sensors shall incorporate a thermistor bead embedded at the tip of a stainless steel tube. Probe style duct sensors shall be used in air handling applications where the air stream temperature is consistent and is not stratified. Averaging sensors shall be employed in all mixing plenum and coil discharge applications and in any other application where the temperature might otherwise be stratified. The averaging sensor tube shall contain at least four thermistor sensors.

7. Immersion sensors shall be employed for measurement of temperature in all chilled water, hot water and glycol applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.

C. Humidity Sensors:

1. Humidity sensors shall be polymer resistance type.

2. Space humidity sensors shall have a sensing range of 05 to 95% with accuracy of +/ 3% RH.

3. Duct sensors and Outdoor air humidity sensors shall have a sensing range of 5 to 95% RH with accuracy of +/ 3% RH. Sensors shall be suitable for ambient temperature conditions of -40 to 212°F.

D. Electric Thermostats:

1. Provide a low voltage thermostat for control of single zone heating and air conditioning unit as specified in the sequence of operation. Electric thermostats shall include a display of the current space temperature as well as a mechanism for adjusting the setpoint locally. Aquastats on unit heaters shall stop the fan when the water temperature is below 100°F.

E. Temperature Sensor, Humidistat Sensor or Thermostat Guards:

1. Provide wire metal guards on thermostats and humidistats located in areas where instruments may be subject to damage, and where called for.

F. Electric Operators (Damper):

1. Provide 24 VAC control operators which are 0-10 VDC input proportional or two position with spring return as needed by control sequence and designed to operate control dampers. Operator shall by synchronous motor driven with up to 150 in. lb. force sensor safety stop and return as required.

G. Control (Motorized) Dampers:

1. Provide control dampers as shown on the drawings and diagrams, to meet the following minimum construction standards.
2. Leakage: Class 1, 4 CFM/sq. ft. at 1 in. W.C., tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage.
3. Frame: 16 gauge galvanized steel structural hot channel with tabbed corners for reinforcement to meet 13 gauge criteria.
4. Blades: 14 gauge (equivalent thickness galvanized steel) roll forward air foil type for low pressure drop and low noise generation. Blades shall be parallel for two-position dampers and opposed, for modulating dampers.
5. Blade Seals: Ruskiprene, suitable for -72°F to +275°F mechanically locked into the blade edge.
6. Jamb Seals: Flexible metal, compression type.
7. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.
8. Bearings: Corrosion resistant, permanently lubricated stainless steel sleeve.
9. Dampers subject to corrosive fumes or humidity shall be constructed of stainless steel.
10. Dampers over 48 in. length and height shall be made in multiple sections.
11. Where damper sizes are not specifically indicated, they shall be sized by the Contractor. Maximum velocity shall be 1500 fpm and maximum pressure drop 0.1 in. w.g.

12. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package Ruskin Model SP-100.

13. Dampers shall be as manufactured by Ruskin CD60 Control Damper, or equivalent Tamco or Greenheck.

H. High Performance Control (Motorized) Dampers:

1. Provide high performance thermally isolated control dampers as shown on the drawings and diagrams, to meet the following minimum construction standards.

2. Leakage: Shall not exceed 4 CFM/sq. ft. at 4 in. W.C., tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage. Holding torque shall not exceed 5 in. lbs./sq. ft. on opposed blade dampers, and 7 in. lbs./sq. ft. on parallel blades with a minimum torque of 40 in. lbs.

3. Frame: .125 in. extruded aluminum structural hot channel with tabbed corners for reinforcement.

4. Blade Seals: Ruskiprene II, suitable for -40°F and with locked into the blade edge extruded silicone, down to -70°F.

5. Jamb Seals: Flexible polycarbonate type.

6. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.

7. Bearings: Corrosion resistant, permanently lubricated molded synthetic.

8. Dampers over 48 in. length and height shall be made in multiple sections.

9. Where damper sizes are not specifically indicated, they shall be sized by the Contractor. Maximum velocity shall be 1500 fpm and maximum pressure drop 0.1 in. w.g.

10. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package Ruskin Model SP-100.

11. Dampers shall be as manufactured by Ruskin CDTI-50 or CDTI-50BF low temperature control damper, or equivalent Tamco or Greenheck.

I. Pressure Sensors:

1. Air pressure or differential air pressure measurements in the range of 0 to 10 in. water column shall be accurate to ± 1% of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Acceptable manufacturer shall be Setra model C-264.

2. Liquid pressure or differential liquid pressure measurements shall be accurate to ± 0.25% of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Unit shall be provided with isolation and bypass

manifold for start-up and maintenance operations. Acceptable manufacturer shall be Setra Model C-230.

3. Steam pressure measurements shall be accurate to ± 0.13% of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Unit shall be provided with isolation and bypass manifold for start-up and maintenance operations. Acceptable manufacturer shall be Setra Model C-207.

4. Room pressure sensors shall be bi-directional, bleed airflow thermistor type. Sensor assembly shall contain three (3) individually wired, hermetically sealed bead-in-glass thermistors. The operating range shall be +3,000 FPM to -3,000 FPM, and device shall have an accuracy of ±2% of readings over the entire operating airflow range. Acceptable manufacturer shall be Ebtron Model GTC116-B.

J. Current Measurement Devices:

1. Measurement of three-phase power shall be accomplished with a kW/kWh transducer. The instrument shall utilize direct current transformer inputs to calculate the instantaneous value (kW) and a pulsed output proportional to the energy usage (kWh). Provide Veris Model 6000 Power Transducer or approved equal.

K. Carbon Dioxide Sensing Devices:

1. Space or outside air carbon dioxide (CO2) sensors shall be an infrared technology based detector, and shall contain an on board relay with field adjustable trip point and adjustable time delay. The sensor shall monitor CO2 over a range of 0 - 2000 PPM. Space CO2 sensors shall operate within the range of 32-122°F and 0-95% RH. Outside air CO2 sensors shall have an operation range of -40° to 122°F and 0-95% RH. The sensor shall have an accuracy of no more than 50 PPM in the expected range of measurement, and a drift of no more 20 ppm. The sensors shall be self-calibrating. Provide an LCD display for displaying PPM level and field adjustable settings. Greystone Product # CDD4 Series, Honeywell C7232, Siemens QPA20, GE Ventostat.

L. Carbon Monoxide Sensing Devices:

1. Wall mounted carbon monoxide (CO) sensor shall be microprocessor based (12 bit accuracy) and shall monitor CO over a range of 0-300 PPM (optional 200-500 PPM). The device shall have an accuracy of ±3% (electrochemical type) or ±5% (solid state type) and operate within the range of 32-122°F and 0-95% RH. The sensor shall have a calibration accuracy of 0.5%. Where required by the drawings or specifications, provide an LCD display for displaying PPM level and system configuration information and/or audible alarm with programmable trip point and disable jumper. Greystone Product # CMD or equivalent.

M. Combination $CO_2$, RH, Temperature Sensors:

1. Provide BACnet combination CO2/RH/Temperature measuring devices for mounting where indicated on the plans.
2. Each BACnet combination sensor shall consist of an integrated system of three or more environment sensing functions in a wall mounted package, with an integral microprocessor-based design capable of operating at least two (2) independent sensor nodes per measurement location.
3. BACnet combination sensors shall have an environmental operating range of no less than 32 – 122° F (0 – 50° C) and 0 – 95% RH, non-condensing.
4. $CO_2$ Sensor Design and Performance:
   a. $CO_2$ measurement shall be accomplished with Non-Dispersive Infrared (NDIR) technology using gold plated optics and diffusion sampling.
   b. $CO_2$ measurement uncertainty shall be no greater than ±75 ppm (or ±7% of Reading <500 ppm and ±7.5% for 800 – 1,200 ppm) at 77° F (25° C) for a $CO_2$ measurement range of at least 400 – 2,000 ppm.
   c. $CO_2$ measurement stability shall be <2% FS over the expected 15 year life of the typical sensor.
   d. Each $CO_2$ sensor node shall be factory calibrated, shall automatically self-calibrate during operation and shall not require routine recalibration throughout its normal service life.
5. Relative Humidity (RH) Sensor Design and Performance:
   a. Each RH sensor node shall measure ambient RH using planar laminated, electrolytic polymer capacitor technology.
   b. RH measurement range shall be 0 – 100% RH, non-condensing.
   c. RH measurement accuracy shall be ±2% from 20% – 80%RH at 77° F (25° C). Outside of this normal RH operating range, accuracy shall be ±3%.
   d. RH output resolution shall be at least 0.4% of Reading.
6. Temperature Sensor Design and Performance:
   a. Each temperature sensor node shall sense changes using integral bandgap voltage reference circuitry and perfectly proportional to absolute temperature (PTAT) ΔV technology.
   b. Temperature measurement accuracy shall be equal to or greater than ±1.08° F at 77° F (±0.6° C at 25° C).
   c. The operating temperature range shall be at least -58° F to 302° F (-50° C to 150° C).
   d. Output resolution shall be at least 0.36° F (0.2° C).
7. Power, Connectivity and Communications:

a. The BACnet combination sensor shall be capable of communicating with other devices using an RS-485 standard interface and BACnet-MS/TP protocol, implemented as a Master.

1) Communication speed shall be field-selectable between 9.6, 19.2, 38.4 and 76.8 kBaud.

b. BACnet devices shall implement the open protocol in compliance of the requirements of ASHRAE Standard 135-2008 and all BACnet products shall be BTL Listed.

c. The BACnet combination sensor shall be capable of field set-up and configuration using a simple dip-switch interface.

d. The BACnet combination sensor shall operate on 24 VAC (22.8 to 26.4 VAC), 50/60Hz.

1) The combination sensor design shall include protection from over voltage, over current transients and power surges.

2) The combination sensor shall use "watch-dog" circuitry to assure automatic processor reset after power disruption, transients and brown-outs.

e. The BACnet combination sensor design shall be capable of communicating to the network if one of the sensor functions becomes faulty, and will continue to operate the remaining $CO_2$ or RH/Temp sensor nodes.

8. The BACnet combination sensor enclosure shall be a low profile wall mount type, compatible in size for mounting with a standard single-gang electrical box or for surface mount applications.

a. The sensors shall be installed at locations that are protected from weather and/or water.

9. The manufacturer’s authorized representative shall review and approve wall-position placement for each measurement location indicated on the plans.

a. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's recommendations or requirements.

10. Acceptable manufacturer shall be Ebtron Model IAQ-300-N.

N. Airflow Stations (DP Type):

1. Duct Mounted Air Flow Stations:

a. Rectangular: 16 gauge galvanized casing, 8 in. deep, with formed 1-1/2 in. integral 90° connecting flanges.

b. Oval: 18 gauge galvanized casing, 8 in. long between beads with 1 in. connecting sleeve on each end (10 in. overall length). Actual

O.D. dimensions are 1/4 in. less than specified duct I.D. dimensions.

c. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

d. Temperature: 350°F continuous operation, 400°F intermittent operation.

e. Humidity: 0-100% continuous operation.

f. Corrosion Resistance: Good salt air, excellent solvent and aromatic hydrocarbon resistance.

g. Element Material: 6063-T5 anodized aluminum.

h. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

i. Design Equipment: Paragon Controls FE-1500.

j. Make: Paragon, Cambridge, Air Monitor.

2. Fan Inlet Air Flow Stations:

a. Material: 6063-T5 anodized aluminum, galvanized mounting brackets.

b. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

c. Temperature: 350°F continuous operation; 400°F intermittent operation.

d. Humidity: 0-100% continuous operation.

e. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

f. Corrosion Resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance.

g. Design Equipment: Paragon Controls FE-1050.

h. Make: Paragon, Cambridge, Air Monitor.

3. Outside Air Flow Station:

a. Material: Element 6063-T5 anodized aluminum and casing 16 gauge G90 galvanized steel.

b. Accuracy: Within ± 0.5% of actual flow through the velocity range of 200 to 12,00 fpm when installed in accordance with published recommendation and within ±5% at a velocity of 100 fpm. Operating velocity range 100 to 2,800 fpm.

c. Temperature: 350°F continuous operation and 400° intermittent operation.

d. Humidity: 0 to 100%.

e. Design Equipment: Paragon Controls mode OAFE-1500.

f. Make: Paragon, Ruskin.

4. Air Volume/Velocity Transducers for Duct Outside Air and Fan Inlet Airflow Stations:

a. The transducer shall be a combination differential pressure transmitter, square rood extractor, scaling multiplier, and output filter with process indication, complete in a single package.

b. The measured air volume shall be locally indicated on a door mounted LED display meter scaled in CFM.

c. The transducer package shall be a factory calibrated for the flow-measuring element being served.

d. A transducer shall be provided for each individual airflow station.

e. Accuracy shall be plus or minus 0.25%.

f. An output signal of 0-10 VDC or 4-20 mA shall be generated for monitoring by the DDC system.

g. Design Equipment: Paragon Controls Microtrans.

h. Make: Paragon, Cambridge, Air Monitor.

O. Airflow Stations (Thermal Dispersion Type):

1. Provide thermal dispersion airflow/temperature measurement device (ATMD) at each location indicated in specifications and control sequences.

a. Fan inlet measurement devices shall not be used unless indicated on drawings or schedules.

b. Each ATMD shall consist of one to four sensor probes and a single, remote transmitter. Each sensor probe shall consist of one to eight independent sensor nodes in a gold anodized, aluminum 6063 alloy tube with 304 stainless steel mounting brackets.

c. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Chip thermistors of any type or packaging are not acceptable.

d. Sensor Density Requirements:

1) Sensor density (#/area) affects minimum installed distances required from disturbance types. Published sensor density data by the product manufacturer shall be submitted for approval. Sensor density shall be as follows:

| Duct or Plenum Area ($ft^2$) | Total # Nodes / Location | Duct or Plenum Area ($m^2$) |
|---|---|---|
| <= 1 | 1 or 2 | <= 0.093 |

| | | |
|---|---|---|
| >1 to <4 | 4 | >0.093 to < 0.372 |
| 4 to < 8 | 6 | 0.372 to < 0.743 |
| 8 to < 12 | 8 | 0.743 to < 1.115 |
| 12 to <16 | 12 | 1.115 to < 1.486 |
| >=16 | 16 | >= 1.486 |

2) The number of individual sensor nodes for each rectangular location shall be maximized for performance within the placement conditions provided. In no instance shall field selected locations provide less distance between disturbances than required for maximum performance. When minimum distances allowed by the highest density of sensor distribution are exceeded, a lower density configuration that provides the same performance is acceptable.

3) Submittal documents shall include schedules indicating the number of sensors per location, the duct area and the equivalent density (#/area) for approval.

e. Each sensing node shall be individually wind tunnel calibrated at 16 points to NIST traceable airflow standards.

f. Each sensing node shall be individually calibrated in constant temperature oil baths at 3 points to NIST traceable temperature standards.

2. Measurement Performance:

a. Each sensing node shall have a temperature accuracy of ± 0.14°F (0.08°C) over the entire operating temperature range of -20°F to 160°F (-28.9°C to 71°C).

b. Each sensing node shall have an airflow accuracy of ± 2% of reading.

c. The ATMD shall be capable of measuring airflow rates over the full range of 0 to 5,000 FPM (25.4 m/s) between -20°F to 160°F (-28.9°C to 71°C).

d. A 3 year warranty shall be provided for the entire system.

3. Integral Transmitter and Communications:

a. The transmitter shall be powered by 24 VAC, be over-voltage and over-current protected, and have a watchdog circuit to provide continuous operation after power failures and/or brown-outs.

b. The transmitter shall determine the airflow rate and temperature of each sensing node prior to averaging.

c. The transmitter shall have two isolated and fused analog output signals and one RS-485 network connection.

d. Each analog output shall be field configurable as linear 0-5/1-5 VDC, 0-10/2-10 VDC or 4-20mA signals.

e. One analog output signal shall provide the average airflow rate.

f. One analog output signal shall be field configurable to output the average temperature, the velocity weighted temperature or a binary airflow alarm.

4. Listings and Certifications:

a. The ATMD shall be UL 973 listed.

b. The ATMD shall be BTL listed.

c. The ATMD shall carry CE Mark for European shipments indicating successful satisfaction of all requirements contained in the EMC Directives, or when otherwise required in the destination country.

5. Design Equipment: Ebtron Model GTC116, HTA-104.

6. Make: Ebtron, Kurz, Sierra.

P. Liquid Flow Measurement:

1. Hi Liquid flow measurement devices shall be accurate to ± 0.75% over a turn down ratio of 10:1. Insertion probe sensing element shall be made of 316l stainless steel. The sensing element shall have an elliptical shape that eliminates the separation point at a fixed or variable location ahead of the static pressure pick up point. Device shall only require one welded insert to mount to piping system. Acceptable manufacturer shall be Preso, model BAR.

Q. Safety/Status Devices:

1. Low Limit Detector: Electric type, with 20 ft. long serpentine element, with manual reset and auxiliary contacts to the DDC, set for 37°F for "freeze" protection and 55°F for fan discharge application. Provide a 20 ft. long element for every 25 sq. ft. of coil face area.

2. High Limit Detector: High limit thermostats shall be located as directed, and shall be manual reset type set at 120°F in the return and 180°F in the discharge. Thermostats shall be double pole so as to provide input capability for alarm at the temperature control system.

3. Pump status shall be provided through adjustable range current sensing element on pump motor.

4. Fan status shall be provided through adjustable range current sensing element on the fan motor.

R. Multi Gas Detection system

1. Wall mounted network controller capibale of detecting carbon monoxide, nitrogen dioxide, hydrogen sulfide, oxygen, methane, hydrogen and propane.
2. Devices shall have dry contact relays 5A @ 250VAC activated upon alarm levels.
3. Devices shall have three (3) alarm levels that are factory set and user adjustable.
4. Devices shall have visual alarm indicators and 85 dBA alarm.
5. Devices shall be 24 VAC / VDC power.
6. Devices shall communicate via RS485 Modbus and BACnet MS-TP master.
7. For spaces with multiple detection devices show a network master controller shall be provided for BMS system integration. This device shall take the signals from all the space multi gas detection units and relay and annunciate alarms.
    a. Unit shall be capable of supporting up to 96 transmitters.
    b. Unit shall have visual indicators for alarm levels.
    c. Unit shall be provided with a remote mounted two (2) light strobe alarm (yellow & Red)
    d. Unit shall have four (4) dry contact relays.
    e. Unit shall be 24 VAC / VDC power.
    f. Unit shall communicate via BACnet/IP.
    g. Unit shall be capable of logging alarms and levels within unit.
    h. Unit shall be mounted in an indistral enclosure.
8. Basis of design for Multi Gas Detectors: Honeywell E3Point.
9. Basis of design for Multi Gas Detector Network Controllers: Honeywell 301C-CDS-BIP.
10. Acceptable Makes: Honeywell, Armstrong Monitoring, Vulcain.

2.02 CONTROL CABINETS

A. BMS control panels shall be fully enclosed cabinet, baked enamel, steel, aluminum or composite material construction and shall meet the requirements of NEMA 1 enclosures. Panels shall have hinged door with a locking latch. Cover exposed electrical connections. Each component on front panel shall have an appropriate engraved label describing its function. Components inside the panel shall be appropriately labeled for ease of identification. Stick-on labels are not acceptable. Panels shall be either free-standing or wall-mounted. Provide support steel framing.

## 2.03 BUILDING MANAGEMENT SYSTEM

A. The BMS system shall consist of Network Controllers, standalone or application specific controllers, input/output unit modules, operator workstations, and file servers to support system configurations. The BMS system shall provide control, alarm detection, scheduling, reporting and information management for the entire facility.

B. The BMS shall be capable of being segmented, through software, into multiple local area networks per floor of building, distributed over a wide area network or sharing a single file server. This enables workstations to manage wide area network, and/or the entire system with all devices being updated and sharing the most current database. In the case of a single workstation system, the workstation shall contain the entire database - with no need for a separate file server.

C. For multi-workstation systems, a file server shall be utilized capable of residing directly on the Owner's Ethernet TCP/IP preferred network with no required gateways. This network may be dedicated for temperature control systems only so it does not interfere with other networks.

D. In addition to the above local area network and wide area network, the workstation software shall be capable of managing remote systems via remote high speed network as a standard component of the software.

E. The BMS system design shall include solutions for the integration of the following "open systems" protocols: BACnet, LonTalk and digital data communication to third party microprocessors such as chiller controllers, fire panels and variable frequency drives (VFD's).

1. The system shall also provide the ability to program custom ASCII communication drivers, which shall reside in the network control unit, for communication to third party systems and devices. These drivers shall provide real time monitoring and control of the third party systems.

## 2.04 NETWORK CONTROLLERS

A. Network Controllers shall be microprocessor based, multi-tasking, multi-user, and employ a real time operating system. Each Network Controller panel shall consist of modular hardware including power supply, CPU board, and input/output modules. A sufficient number of Network Controllers shall be supplied to fully meet the requirements of this specification and the point list on the drawings.

B. All Network Controllers on the Ethernet TCP/IP LAN/WAN shall be capable, out-of-the box, to be set up as a Web Server. The Network Controllers shall have the ability to store HTML code and "serve" pages to a web browser. This provides the ability for any computing device utilizing a TCP/IP Ethernet connection and capable of running a standard Internet browser (Microsoft Internet Explorer, Netscape Navigator, etc.) to access real-time data from the entire Temperature Control System via any Network Controllers.

1. Graphics and text-based web pages shall be constructed using standard HTML code. The interface shall allow the user to choose any of the standard text or graphics-based HTML editors for page creation. It shall also allow the operator to generate custom graphical pages and forms.
2. The WEB server interface shall be capable of password security, including validation of the requesting PC's IP address. The WEB server interface shall allow the sharing of data or information between any controller or process or network interface (BACnet, LonTalk and TCP/IP) that the Temperature Control System has knowledge of, regardless of where the point is connected on the Temperature Control System network or where it is acquired from.
3. The network controller shall act directly as the WEB server. It shall directly generate HTML code to the requesting user (i.e. WEB browser), eliminating the need for and reliance on any PC-based WEB server hardware or software. To simplify graphic image space allocation, HTML graphic images, if desired, shall be stored in any shared network device. The Web server shall have the ability to acquire any necessary graphics using standard pathing syntax within the HTML code mounted within the Temperature Control System WEB server. External WEB server hardware and software are not acceptable.

C. Hardware Specifications:

1. A minimum of 4MB of RAM shall be provided for Network Controllers with expansion up to 8MB.
2. Each Network Controller shall provide communication to both the Workstation(s) and the field buses. In addition, each Network Controller shall have at least three other communications ports that support a telephone modem, portable service tool, serial printer and connection to third party controllers such as a chiller control panel. On a LAN/WAN system, the Network Controller shall be provided with a 10Mbps plug-in Ethernet TCP/IP network interface card (NIC).
3. Input/Output (I/O): Each Network Controller shall support the addition of the following types of inputs and outputs:
   a. Digital Inputs for status/alarm contacts.
   b. Counter Inputs for summing pulses from meters.
   c. Thermistor inputs for measuring temperatures in space, ducts and thermowells.
   d. Analog inputs for pressure, humidity, flow and position measurements.
   e. Digital Outputs for on/off equipment control.
   f. Analog Outputs for valve and damper position control, and capacity control of primary equipment.

4. The system shall employ a modular I/O design to allow easy expansion. Input and output capacity is to be provided through plug-in modules of various types or DIN-mountable IOU modules. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.

5. Each Network Controller shall include a battery-backed, real time clock, accurate to 10 seconds per day. The Real Time Clock shall provide the following: time of day, day, month, year, and day of week. In normal operation, the system clock shall be based on the frequency of the AC power. The system shall automatically correct for daylight savings time and leap years.

6. The power supply for the Network Controllers shall be auto sensing, 120-220VAC, 60/50 Hz power, with a tolerance of ±20%. The controller shall contain over voltage surge protection, and require no additional AC power signal conditioning. Optionally, if indicated on the drawings, the power supply shall accept an input voltage of (-48 VDC).

7. Upon restoration of power after an outage, the Network Controller shall automatically and without human intervention: Update all monitored functions; resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

8. Each Network Controller with the standard 120-220VAC power supply shall include a programmable DC power backup system rated for a minimum of 72 hours of battery backup to maintain all volatile memory or, a minimum of two (2) hours of full UPS including modem power. This power backup system shall be configurable such that at the end of a settable timeframe of running on full UPS, the unit shall shut off full UPS and switch to memory retention-only mode for the remainder of the battery power. The system shall allow the simple addition of more batteries to extend the above minimum battery backup times.

D. Software:

1. The Network Controller shall contain flash ROM as the resident operating system. Application software shall be RAM resident. Application software shall only be limited by the amount of RAM memory. There shall be no restrictions placed on the type of application programs in the system. Each Network Controller 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.

2. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be English language-based and

programmable by the user. The language shall be structured to allow for the easy configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, passwords, and histories. The language shall be self-documenting. Users shall be able to place comments anywhere in the body of a program. Program listings shall be configurable by the user in logical groupings.

E. Control Software:

1. The Network Controller 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.
2. Mathematical Functions: 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 shall be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.
3. Energy Management Applications: Network Controllers shall have the ability to perform any or all of the following energy management routines:
   a. Time of Day Scheduling
   b. Calendar Based Scheduling
   c. Holiday Scheduling
   d. Temporary Schedule Overrides
   e. Optimal Start
   f. Optimal Stop
   g. Night Setback Control
   h. Enthalpy Switchover (Economizer)
   i. Peak Demand Limiting
   j. Temperature Compensated Duty Cycling
   k. CFM Tracking
   l. Heating/Cooling Interlock
   m. Hot/Cold Deck Reset
   n. Free Cooling
   o. Hot Water Reset
   p. Chiller Sequencing

q. Static Pressure Reset/Optimizing

r. Demand Controlled Ventilation

s. Supply Air Temperature Reset

4. Each controller shall be capable of logging any system variable over user defined time intervals ranging from 1 second to 1440 minutes. Any system variables (inputs, outputs, math calculations, flags, etc.) can be logged in history. A maximum of 25,000 values can be stored in each log. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logs can be automatic or manual. Logged data shall be downloadable to the Operator Workstation for long term archiving based upon user-defined time intervals, or manual command.

5. Alarm Management: For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms shall be tested each scan of the Network Controller and can result in the display of one or more alarm messages or reports.

   a. Up to eight (8) alarms can be configured for each point in the controller.

   b. Messages and reports can be sent to a local terminal, to the front-end workstation(s), or via modem to a remote-computing device.

   c. Alarms shall be generated based on their priority. A minimum of 255 priority levels shall be provided.

   d. If communication with the Operator Workstation is temporarily interrupted, the alarm shall be buffered in the Network Controller. When communications return, the alarm shall be transmitted to the Operator Workstation if the point is still in the alarm condition.

6. The Network Controller shall be able to generate user-definable reports to a locally connected printer or terminal. The reports shall contain any combination of text and system variables. Report templates shall be able to be created by users in a word processing environment. Reports can be displayed based on any logical condition or through a user command.

## 2.05 STANDALONE CONTROLLERS

A. Standalone Controllers shall provide control of HVAC and lighting. Each controller shall have its own control programs and shall continue to operate in the event of a failure or communication loss to its associated Network Controllers.

B. Standalone Controllers programs shall be stored in battery backed-up RAM and EPROM. Each controller shall have a minimum of 32K bytes of user RAM memory and 128K bytes of EPROM.

C. Standalone Controllers shall provide a communication port to the field bus. In addition, a port shall be provided for connection of a portable service tool to support local commissioning and parameter changes with or without the Network Controllers online. It shall be possible from a service port on any Standalone

Controller to view, enable/disable, and modify values of any point or program on any controller on the local field bus, any Network Controller or any Standalone Controller on a different field bus.

D. Support BACnet standard MS/TP bus protocol ASHRAE SS PC-15, Clause 9 on the control network.

E. Each Standalone Controller shall support the addition of the following types of inputs and outputs:

1. Digital Inputs for status/alarm contacts.
2. Counter Inputs for summing pulses from meters.
3. Thermistor Inputs for measuring temperatures in space, ducts and thermowells.
4. Analog inputs for pressure, humidity, flow and position measurements.
5. Digital Outputs for on/off equipment control.
6. Analog Outputs for valve and damper position control, and capacity control of primary equipment.

F. Input and output capacity shall be expandable through the use of plug-in modules. A minimum of two (2) modules shall be added to the base Standalone Controller before additional power is required.

G. Each Standalone Controller shall be able to exchange information on a peer to peer basis with other Standalone Controllers during each field bus scan. Each Standalone Controller shall be capable of storing and referencing global variables (on the LAN) with or without any workstations online. Each Standalone Controller shall be able to have its program viewed and/or enabled/disabled either locally through a portable service tool or through a workstation connected to a Network Controller.

H. Standalone Controllers shall have as a minimum, LED indication of CPU status, and field bus status.

I. Standalone Controllers shall have a real time clock in either hardware or software. The accuracy shall be within 10 seconds per day. The Real Time Clock shall provide the following information: time of day, day, month, year, and day of week. Each Standalone Controller shall receive a signal over the network from the Network Controllers, which synchronizes all Standalone Controllers real time clocks.

J. Upon restoration of power, the Standalone Controller shall automatically and without human intervention, update all monitored functions, resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

K. Each Standalone Controller shall have at least three (3) years of battery back up to maintain all volatile memory.

L. For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms shall be tested each scan of the Standalone Controllers and can result in the display of one or more alarm messages or reports.

1. Up to eight (8) alarms can be configured for each point in the controller enabling the escalation of the alarm priority (urgency) based upon which alarm(s) is/are triggered.
2. Alarm messages can be sent to a local terminal or modem connected to a Network Controller or to the Operator's Workstation(s).
3. Alarms shall be generated based on their priority. A minimum of 255 priority levels shall be provided.
4. If communication with the Network Controller is temporarily interrupted, the alarm shall be saved in the Standalone Controller. When communications return, the alarm shall be transmitted to the Network Controller if the point is still in the alarm condition.

M. Air Handler Controllers shall be capable of meeting the requirements of the sequence of operation intended for each system and allow for future expansion.

1. Air Handling Unit Controllers shall support all the necessary point inputs and outputs as required by the sequence and operate in a standalone fashion.
2. Air Handling Unit Controllers shall be fully user programmable to allow for modification of the application software.
3. An LCD display shall be optionally available for readout of point values and to allow operators to change setpoints and system parameters.
4. A manual override switch shall be provided for all digital and analog outputs on the Air Handling Unit Controller. The position of the switch shall be monitored in software and available for operator displays and alarm notification.

N. Air Terminal Unit Controllers:

1. Air Terminal Unit Controllers shall support, but not be limited to the control of the following configurations of Air Terminal Units to address current requirements as described in the Execution portion of this specification, and for future expansion:
   a. Single Duct Cooling Only
   b. Single Duct Cooling with Reheat (Electric or Hot Water)
   c. Fan Powered (Parallel or Series)
   d. Dual Duct (Constant or Variable Volume)
   e. Supply/Exhaust
2. Air Terminal Unit Controllers for single duct applications shall be provided with a built-in actuator for modulation of the air damper. The actuator shall have a minimum torque rating of 35 in.-lb., and contain an

override mechanism for manual positioning of the damper during startup and service.

3. Air Terminal Unit Controllers shall contain an integral velocity sensor accurate to ±5% of the full range of the box's CFM rating.

4. Each controller shall perform the sequence of operation described in Part 3 of this specification, and have the capability for time of day scheduling, occupancy mode control, after hours operation, lighting control, alarming, and trending.

5. Air Terminal Unit Controllers shall be able to communicate with any other Standalone Controllers on the same field bus with or without communication to the Network Controllers managing the field bus. Systems that fail to provide this (true peer-to-peer) capability will be limited to a maximum of 32 Air Terminal Unit Controllers per field bus.

O. Unitary Controllers:

1. Unitary Controllers shall support, but not be limited to, the control of the following systems as described in the Execution portion of this specification, and for future expansion:

a. Unit Ventilators

b. Heat Pumps (Air to Air, Water to Water)

c. Packaged Rooftops

d. Fan Coils (2 or 4 Pipe)

2. The I/O of each Unitary Controller shall contain the sufficient quantity and types as required to meet the sequence of operation found in the Execution portion of this specification. In addition, each controller shall have the capability for time of day scheduling, occupancy mode control, after hour operation, lighting control, alarming, and trending.

## 2.06 OPERATOR HARDWARE

A. The BMS workstation software shall be configurable as either a single workstation system (with a local database) or multi-workstation system where the database is located on a central file server. The client software on multi-workstation system shall access the file server database program via an Ethernet TCP/IP network running at either 100MBPS or 1024MBPS.

1. All Workstations shall be Intel Core Processor based personal computers operating under the Microsoft Windows Server 2012 R2. The application software shall be capable of communication to all Network Controllers and Standalone Controllers, feature high-resolution color graphics, alarming, reporting, and be user configurable for all data collection and data presentation functions.

2. For multi-workstation systems, a minimum of 256 workstations shall be allowed on the Ethernet network along with the central file server. In this client/server configuration, any changes or additions made from one

workstation shall automatically appear on all other workstations without the requirement for manual copying of files. Multi-workstation systems with no central database will not be acceptable. Multi-workstation systems with distributed/tiered file servers and a central (master) database will be acceptable.

B. File Server Requirements. The file server shall consist of the following:

1. Base Unit: 2.53GHZ/4-core/80W/8MB Xeon processor.
2. Memory: 8 GB, 1 x 8GB PC3-10600 registered dual rank x 4.
3. Hard Drives: (3) @ TB 3G SATA, 10K Hot Plug 3.5.
4. Optical Drive: Half-height SATA DVD- RW Optical Drive.
5. Network Controller: NCZ82T PC Express dual port multifunction gigabit server adapter.
6. 18.5 in. diagonal widescreen thin film transistor LCD active matrix, resolution 1366 x 768.
7. PCI Graphics Adapter w/8Mb RAM.
8. Provide server grade keyboard and mouse.
9. Software: Microsoft Windows 2012 R2.
10. HP ProLiant ML350 Series, or equal.

C. Workstation Requirements: The workstation shall consist of the following:

1. Base Unit: 3.33 GHz, 1.5 MB, L2 + 12 MD Shared L3 cache.
2. Memory: 12 GB DDR3-1066 MHz SDRAM.
3. Primary Hard Drive: 1.5 TB RAID 1 (2 x 1.5 TB SATA HDDS).
4. Secondary Hard Drive: 1.5 TB 7200 RPM SATA 2Gb/s.
5. CD Drive: Blu-Ray player and light scribe super multi DVD burner.
6. Graphics Card: 1 GB NVIDIA Geforce 460 2 DVI, mini-HDMI, VGA adapter.
7. 18.5 in. diagonal widescreen thin film transistor LCD active matrix, resolution 1366 x 768.
8. Keyboard and Mouse: USB keyboard and optical mouse.
9. Software: Microsoft Office Professional 2010.
10. HP Pavilion Elite HPE-800 Series, or equal.

D. Printer: Provide a workstation printer to display alarms and graphics. The printer is to be a HP Officejet Pro 8100, or equal.

## 2.07 WORKSTATION SOFTWARE

A. General Description:

1. The software architecture shall be object-oriented in design, a true 32-bit application suite utilizing Microsoft's OLE, COM, DCOM and ODBC

technologies. These technologies shall make it easy to fully utilize the power of the operating system to share, among applications (and therefore to the users of those applications), the data available from the Temperature Control System.

a. The workstation functions shall include monitoring and programming of all BMS 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.

b. Programming of controllers shall be capable of being done either off-line or on-line from any operator workstation. All information shall be available in graphic or text displays. Graphic displays shall feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the BMS system. All operator functions shall be selectable through a mouse.

2. The file server database engine shall be Microsoft SQL Server, or another ODBC-compliant, relational database program. This ODBC (Open Database Connectivity) compliant database engine shall allow for an Owner to utilize "their" choice of database and due to its "open" architecture, shall allow an Owner to write custom applications and/or reports that communicate directly with the database avoiding data transfer routines to update other applications. The system database shall contain all point configurations and programs in each of the controllers that have been assigned to the network. In addition, the database shall contain all workstation files including color graphic, alarm reports, text reports, historical data logs, schedules, and polling records.

3. The BMS workstation software shall allow the creation of a custom, browser-style interface linked to the user that has logged into the workstation software. 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 shall 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 Microsoft Office Professional 2010 user security capabilities, shall enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BMS 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 shutdown the active alarm viewer and/or unable to load software onto the PC.

4. 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 shall allow a minimum of 256 users to be configured per workstation. There shall be an inactivity timer adjustable in software that automatically logs off the current operator after the timer has expired.

5. 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. Object names shall not be required to be unique throughout the system allowing for point naming convention consistency. For example, each Air Temperature Unit Controller can have an input called Space Temperature and a setpoint called CFM Setpoint.

   a. The configuration interface shall also include support for template objects. These template objects shall be used as building blocks for the creation of the BMS database. The types of template objects supported shall include all data point types (input, output, string variables, setpoints, etc.), alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of template object types shall be able to be set up as template subsystems and systems. The template system shall prompt for data entry if necessary. The template system shall maintain a link to all "child" objects created by each template. If a user wishes to make a change to a template object, the software shall ask the user if he/she wants to update all of child objects with the change. This template system shall facilitate configuration and programming consistency and afford the user a fast and simple method to make global changes to the BMS.

6. Color Graphic Displays: 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 using the mouse. Requirements of the color graphic subsystem include:

   a. LCD active matrix, resolution 1366 x 768 displays. The user shall have the ability to import AutoCAD generated picture files as background displays.

   b. A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, and graphs which can be "dropped" on a graphic using 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. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.

c. Status changes or alarm conditions shall be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.

d. Graphic panel objects shall be able to be configured with multiple "tabbed" pages allowing an operator to quickly view individual graphics of equipment, which make up a subsystem or system.

e. Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators shall be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.

7. The software shall allow for the automatic collection of data and reports from any controller through either a hardwire or modem communication link. The frequency of data collection shall be completely user-configurable.

8. The software shall be capable of accepting alarms directly from 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) shall be integrated into the overall alarm management system and shall appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports. Alarm management features shall include:

a. A minimum of 255 alarm notification levels, or classes of alarms. Each notification level shall establish a unique set of parameters for controlling alarm display, acknowledgment, keyboard annunciation, alarm printout and record keeping.

b. Automatic logging in the database of the alarm message, point name, point value, connected controller, timestamp, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).

c. Automatic printing of the alarm information or alarm report to an alarm printer or report printer.

d. Playing an audible beep or audio (wav) file on alarm initiation or return to normal.

e. Sending an email or text message to anyone listed in a workstation's email account address list on either the initial occurrence of an alarm and/or if the alarm is repeated because an operator has not acknowledged the alarm within a user-configurable timeframe. The ability to utilize email and texting of

alarms shall be a standard feature of the software integrated with the operating system's mail application interface (MAPI). No special software interfaces shall be required.

f. Individual alarms shall be able to be re-routed to a workstation or workstations at user-specified times and dates. For example, a critical high temperature 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.

g. An active alarm viewer shall be included which can be customized for each user or user type to hide or display any alarm attributes.

h. The font type and color, and background color for each alarm notification level as seen in the active alarm viewer shall be customizable to allow easy identification of certain alarm types or alarm states.

i. The active alarm viewer can be configured such that an operator shall type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.

9. The software shall contain a built-in custom report generator, featuring word processing tools for the creation of custom reports. These custom reports shall be able to be set up to automatically run or be generated on demand. Each workstation shall be able to associate reports with any word processing or spreadsheet program loaded on the machine. When the report is displayed, it shall automatically spawn the associated report editor, which shall be the most recent version of Microsoft Office.

a. Reports can be of any length and contain any point attributes from any controller on the network.

b. The report generator shall have access to the user programming language in order to perform mathematical calculations inside the body of the report, control the display output of the report, or prompt the user for additional information needed by the report.

c. It shall be possible to run other executable programs whenever a report is initiated.

d. 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.

e. Standard reports shall include:

1) Points in each controller.

2) Points in alarm.

3) Disabled points.

4) Overridden points.

5) Operator activity report.

6) Alarm history log.

7) Program listing by controller with status.

8) Network status of each controller.

10. Spreadsheet-Style Reports: The software shall allow the simple configuration of row/column (spreadsheet-style) reports on any class of object in the system. These reports shall be user-configurable and shall be able to extract live (controller) data and/or data from the database. The user shall be able to set up each report to display in any text font, color and background color. In addition, the report shall be able to be configured to filter data, sort data, and highlight data that meets user-defined criteria.

11. HTML Reporting: The above spreadsheet-style reports shall be able to be run to an HTML template file. This feature shall create an HTML "results" file in the directory of the HTML template. This directory can be shared with other computer users, which shall allow those users with access to the directory to "point" their web browser at the file and view the report.

12. Scheduling: It shall be possible to configure and download from the workstation schedules for any of the controllers on the network.

    a. Time of day schedules shall be in a calendar style and shall be programmable for a minimum of one year in advance. Each standard day of the week and user-defined day types shall be able to be associated with a color so that when the schedule is viewed it is very easy, at-a-glance, to determine the schedule for a particular day even from the yearly view. To change the schedule for a particular day, a user shall simply click on the day and then click on the day type.

    b. Each schedule shall 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.

    c. Schedules shall be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation shall be automatically updated to the corresponding schedule in the controller.

13. The programmer's environment shall include access to a superset of the same programming language supported in the controllers. In this environment, the programmer shall be able to configure application software off-line (if desired) for custom program development, write global control programs, system reports, wide area networking data collection routines, and custom alarm management software. On the same screen as the program editor, the programming environment shall include dockable debug and watch bars for program debugging and viewing

updated values and point attributes during programming. In addition, a wizard tool shall be available for loading programs from a library file in the program editor.

14. The workstation software shall have an application to save and restore field controller memory files. This application shall not be limited to saving and reloading an entire controller - it shall 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.

15. The workstation software shall have the capability to easily configure groups of data points with trend logs and display the trend log data. A group of data points shall be created by drag-and-drop method of the points into a folder. The trend log data shall be displayed through a simply menu selection. This data shall be able to be saved to file and/or printed.

16. 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.

17. Fault Tolerant File Server Operation: The system shall provide the option to provide fault tolerant operation in the event of the loss of the CPU, disk drives, or other hardware required to maintain the operational integrity of the system. Operational integrity includes all user interfaces, monitoring of alarm points and access points, and executing access control functions. Fault tolerant technology is not provided unless specifically stated.

    a. The switchover mechanism provided shall be automatic. Should the failure be caused by hardware, then the system shall immediately switch to the Backup computer. Should the system failure be caused by software (instruction or data), the system shall not pass the faulted code to the Backup computer, otherwise the Backup shall fail in the same manner of the Primary computer.

    b. Switchover to the Backup computer shall be initiated and effective (complete) in a manner and time frame that precludes the loss of event data, and shall be transparent to the system users, except for an advisory alarm message indicating that the switchover has occurred.

    c. When the system fails-over from the Primary to the Backup computer, no alarm or other event shall be lost, and the Backup computer shall take control of all system functions.

    d. 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.

e. The Primary computer shall provide continual indication that the Backup computer is unavailable until such time that the fault has been purged.

## 2.08 WEB BROWSER INTERFACE

A. Provide a web browser interface that will be accessible to any computer on the Owner's Intranet with Microsoft Internet Explorer 8.0 or higher. The system shall support a minimum of 5 simultaneous users to access the system. The Web Browser Interface shall include the following features.

1. Day-to-day operation of the system shall be accessible through a standard web browser interface, allowing technicians and operators to view any site in the system from anywhere on the network.
2. The browser-based interface must share the same graphical displays as the Operator Workstations, presenting dynamic data on site layouts, floor plans, and equipment graphics. The browser's graphics shall also support commands to change setpoints, enable/disable equipment and start/stop equipment.
3. Through the browser 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 copy stored in the system database.
4. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
5. Through the browser interface, operators must be able to change schedules - change start and stop times, and add new times to a schedule.
6. Through the browser interface, operators must be able to create and edit card access personnel records, and assign the card to any and all sites for access, in any combination.
7. Through the browser interface, operators must be able to view reports of access events and access privileges. Reports must be available based on start and end time, door, area, and person. Invalid attempts must be color-coded red in the report.
8. Through the browser interface, operators must be able to view live and recorded video from any digital video recorder on the network. The interface must offer an easy method of selecting the camera to view, and for recorded video, must offer selections for start and stop time when searching video clips.
9. 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.
10. 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.

11. The system shall be expandable to up to 25 concurrent browser-based users per server.

## 2.09 UTILITY METERING

A. General Requirements:

1. The following meters shall be included in this system:
   a. Electric Meter (Quantity one (1) per building).
   b. Gas Meter (Quantity one (1) per building).
   c. Water Meter (Quantity one (1) per building).
2. Provide all hardware, software, installation labor and information required to contractors involved in the project to effect the installation of an Automated Controller Polling system as specified herein. The system shall be capable of providing information to the facility operational staff and others empowered to have and use the information as directed by the administration. The system shall be complete in every respect as specified and shall provide all information required to affect the output of the reports defined in the relevant section of this specification. The supplier shall provide two certifications that the system is tracking with the utility meters. One certification shall be provided as the system is turned over to the owner. The second certification shall be provided after six to eight months of operation. The protocol for the certification process is included in this specification and shall be rigidly adhered to. The system information sensors cross contract section responsibilities, and as such require coordination. The system supplier shall be responsible to coordinate the contractor to see that the utility sensors required by their respective sections are provided and work properly. The system supplier is not responsible for the provision or installation of the primary sensing elements of this system. They are the responsibility of the section that provides the utility service to the facility and are specified under the appropriate sections. Further, it is not the responsibility of the system supplier to coordinate with the utility company to see that the sensors are supplied and are provided with the necessary information. That responsibility is also specified in the appropriate sections.

B. System Field Hardware and Installation:

1. Provide and install all hardware required to connect to utility primary meter auxiliary output sensors provided by others to collect information required to generate reports as defined in the report section of this document. The hardware shall collect and store data for retrieval by a central server through the facility intranet and over the Internet. A 10BaseT network tap with a Fixed IP address for the building controller shall be provided by others to provide system connectivity to the Intranet.
2. Contract with the utility companies to install auxiliary pulse contacts on all meters monitored.

3. The building controller shall be connected to an application controller that shall receive pulses proportional to utility use. Provide and install the application controller with necessary input characteristics to be compatible with the primary utility sensing equipment. Connect controller inputs to the meter auxiliary outputs at the point shown on the drawings where the utility meter sensor terminations are shown to be connected.

C. System Polling Server:

1. Provide at the system supplier facility a polling server service that will poll every meter for the consumption of utility commodity every sixty (60) minutes.
2. Data shall be stored in an approved supported SQL database such as Microsoft SQL Server. The server polling process shall be self-healing so as to automatically recover back data in conditions where Internet outages occur for an adjustable period of minimum six (6) hours to a maximum of seven days.
3. The data collection application controllers that interface directly with the meter pulsing head sensors shall be capable of storing data for a minimum period of the previous seven (7) days so as to provide the source for the data recovery outlined above.
4. The system shall incorporate a temperature-sensing device, and collect data from the same for outdoor air. This data shall be used to provide for the calculation of degree-day information for use in daily energy analysis formats.

D. User Report Interface:

1. The system shall provide the user with a menu driven interface, which shall contain a menu driven interface for the purpose of report configuration, storage and advanced analysis.

E. The application shall provide the following:

1. Provide a Site Manager interface to browse building sites and the meter sources, grouped by commodity. Information displayed shall provide for the ability to map meter sources back to their related software points at the data input interface for ready field identification and system cross reference.
2. Provide a Rate Manager interface, permitting the user to enter and store a unit cost for each commodity tracked in the system, giving the user the ability to analyze financial impact, as provided for in reports listed in the Energy Reports section of this specification.
3. Provide a Report Manager interface, which provides the user with the ability to select the desired Commodity to be examined and between Daily and Hourly Reports. The report manager interface shall be calendar driven to provide for easy selection of data set date ranges. The report manager interface shall permit the user to dynamically choose any number

of building sites to include in a report, as well as save reports that can be easily recalled for the purposes of analysis against events such as billing cycles.

4. Provide a function to allow the user to create and save groups of buildings to allow for ease of use when benchmarking buildings against each other.

5. Daily reports shall contain:

   a. Summary Report page plotting all buildings polled against each other for Consumption, Consumption per square foot, and Load Consumption Ratio.

   b. Summary Data page charting all buildings polled against each other for Consumption, Consumption per square foot, and Load Consumption Ratio.

   c. Building Area page ranking buildings from highest to lowest square footage.

   d. Energy Mark page ranking all buildings polled from highest to lowest energy savings potential based upon Energy per square foot, Load Ratio, and Energy used.

   e. Weather Data page providing daily weather history including outside air temperature, heating degree days, and cooling degree days.

   f. Page for each building polled containing:

      1) Total Consumption for period polled.

      2) Consumption per square foot of building area for period polled.

      3) Daily Consumption Total.

      4) Daily Consumption per square foot of building area.

      5) Daily Peak Demand and time.

      6) Daily Low Demand and time.

      7) Night Consumption as total.

      8) Night Consumption as a percentage of total consumption.

      9) Daily Night Consumption Total.

      10) Daily Night Consumption per square foot of building area.

      11) Day Consumption as total.

      12) Day Consumption as a percentage of total consumption.

      13) Daily Day Consumption Total.

      14) Daily Day Consumption per square foot of building area.

      15) Load Ratio comparing night and day consumption totals.

      16) Daily Load Ratio comparing daily night and day consumption.

6. Hourly reports shall contain:
   a. Page for each building polled containing:
      1) Total Consumption for period polled.
      2) Night Consumption as percentage of total consumption.
      3) Day Consumption as percentage of total consumption.
      4) Load ratio comparing night and day consumption totals.
      5) Consumption for each hour of period polled.

2.10 SURGE SUPPRESSION (SP) RECEPTACLE

A. Provide at each DDC panel and operator workstation locations, a surge suppression receptacle with metal oxide varister to dissipate the electrical energy of voltage spikes. 20 ampere, duplex, NEMA 5-20R configuration. Back and side wiring, high impact nylon body.

B. Acceptable Make: Hubbell 5352-S.

2.11 GRAPHICS

A. System Graphic:
   1. The equipment drawing will be three-dimensional. The values on the screen shall be reported in real time as well as dynamic to be updated as the value changes.
   2. All components of the drawing will show their actual field location and position. Sensors will be in the exact location in reference to piping and air stream. Icons or "library" images imported during the construction of the drawing will be accurate in depiction of the device and any interaction with other components of the drawing, i.e. don't draw piping into the motor of a pump icon.
   3. If there are size limitations or clutter from the number of components a link to a sub graphic having the same layout will be used to clarify.

B. Space Graphic:
   1. Floor plan drawings will be linked to the supplying air handling unit or in some cases to the exhaust fan. Electronic floor plans to be provided by Architect/Engineer.
   2. Floor plans showing areas served by more than one air handling unit will have the areas color-coded by air handling unit. If the air-handling unit serves different floors the color will be consistent for an air-handling unit for all floors.
   3. If an area has control other than DDC it will be noted with text and left white in the background.
   4. A temperature zone serving more than one space shall have a unique pattern, to distinguish that zone from other temperature zones. The

patterns should slight enough as to not obscure the space temperature, room number and borders detail but visible enough to be able to distinguish between different zones. A different "peppering" of symbols (of + ˆ * ≈) or patterns (hex, herringbone, verticals, etc.) will be used to define the zones.

5. Temperature zones dedicated to only one space will not have to be detailed.

6. Remote physical points such as differential monitors and the like shall be shown in their installed location.

C. The second level of graphics shall be all the DDC points to be installed under the contract overlaid on building floor plan and the Air Handling Unit and its associated systems. Electronic floor plans to be provided by Architect/Engineer.

D. Description of Operation:

1. The approved description of operation will appear on a text graphic in 12-point text written in paragraph form.

2. Additional notes may appear on the equipment graphic in an appropriate location.

E. Layout:

1. The subject device of equipment graphic will be centrally located on the drawing.

2. At the top center, the name of the equipment device will be displayed with its room number. Immediately below the PM# will be displayed. On a third line will be the capacity of the device in units common to that device i.e. air handling units in CFM, pumps in GPM.

3. The top right hand corner will contain links to associated graphics. The Description of Operation, submittal graphic, space graphic and graphic index page will be typical. Other links may be required. All graphic pages will have backward link to return to the main System Graphic.

4. The top left-hand corner will contain global data. Outside Air would be the most common other values may be required when related to the device operation. If the global data functions within the program of this unit, the point referenced in the program will be displayed.

5. The lower left-hand corner will display the operational modes of the device. Occupied, warm up, winterized and economizer would be common. Other modes will be displayed if the unit uses them.

6. In the upper right-hand area, just below the links, the setpoints of the device will be displayed. All setpoints in the various control loops of the device, DA temp, static pressure, MA will be placed in columns as the drawing permits.

7. The date of the last revision of the graphic will be displayed in the lower right corner.

F. Text:

1. Text will contrast with the background for easy reading.
2. The text will be free floating without borders or boxes unless specifically required.

G. The graphics shall include approved schematic of the equipment, sequence of operation and all wiring interface diagrams.

H. The graphic shall include all new systems, equipment and spaces.

## PART 3 - EXECUTION

### 3.01 GENERAL SYSTEM REQUIREMENTS

A. The control of each system shall be guaranteed to perform as described in the Sequence of Operation on the drawings. Equipment, remote switches, in finished rooms shall be flush-mounted, if possible. Interlock supply and return fans, humidifiers with fans, condensers or cooling towers with air conditioning equipment and similar situations demanding coordinated operation.

### 3.02 SYSTEM COMPONENTS

A. Valves: Union or flanged connected. Locate close to apparatus controlled with pipe reducers and increasers located closest to valve. Locate, arrange, and pipe per installation diagram.

B. Mounting height for all room thermostats or sensors shall be 48 in. to the top of the cover.

C. Locate thermostats on walls symmetrical with adjacent items. Verify exact room location to avoid doors, fixed and portable equipment. Install to minimize damage. Do not install adjacent to lighting dimmers or other heat generating equipment.

D. Dampers and Damper Operators: Tag dampers for proper location. Install per manufacturer's printed instruction as to motor size and quantity, linkage arrangement, drive connection point. Adjust to close tightly. Allow for conduit sleeve or blank space for roof fan dampers. Where ducts are insulated, set damper operators at least 2 in. away from side of duct to allow for insulation.

### 3.03 SMOKE DAMPERS AND FIRE/FAN SHUT DOWN

A. Provide control for smoke dampers as required. Division 26 "Electric" to provide 120 volt power wiring and associated signal wiring to close all smoke partition smoke dampers associated with a particular air handling unit upon alarm at any duct smoke detector in that particular system.

B. Division 26 "Electric" to provide a signal to stop air handling unit fans and close air handling unit smoke dampers upon activation of the fire alarm system. Wiring to be directly to the motor starter.

C. The DDC Subcontractor shall provide control wiring for a digital input point for an end switch that shall prevent the operation of the air handling unit fans until its corresponding smoke dampers are proven fully open

D. Division 26 "Electric" shall also provide a signal to the DDC control system that the fire alarm system is activated.

3.04 LOW AND HIGH LIMIT SAFETY FUNCTIONS

A. Provide for all supply fan units. Wiring to be directly to the motor starter. High limit controller (firestat) shall be located in the unit discharge, set at 180□F and prevent the fan from operating until reset. High limit shall alarm DDC system. Low limit shall be strung on the discharge face of preheat coils set at 37□F. Low limit shall: prevent fan from operating, set heating coils to full heat, fully close the outside air damper, fully close the relief air dampers, open return air damper, and alarm DDC system until reset.

3.05 SYSTEM TESTING AND COMMISSIONING

A. At the time of installation, systems shall be tested for control device operation prior to the systems acceptance. A report of each systems performance shall be submitted to the Owner's Representative. The report shall include:

1. Field verification and demonstration checklist of analog input calibration, analog output operation, digital input function, and digital output operation.
2. Trend log of inputs and output, printed every two (2) hours, for one (1) week.
3. Refer to "Instructions and Adjustments".

3.06 SYSTEM DESCRIPTION - GENERAL

A. All systems shall maintain the scheduled or otherwise noted minimum outside air ventilation rate during building occupied hours.

B. Provide normally open hot water and normally closed cooling coil valves.

C. Provide normally open return air damper, normally closed relief air and normally closed outside air dampers and operators.

D. Mode of operation (occupied/unoccupied) including building warm-up and pull-down cycles, as well as all system functions shall be programmable and controlled by the BMS system.

E. Shutdown of air handling units and fans due to a fire alarm shall be by the Contractor. The fire alarm system will send a signal to the BMS system for

monitoring purposes only of each air handling unit and exhaust system. The BMS system will provide a staggered restart of the units once the alarm is cleared.

F. All setpoints shall be adjustable.

G. Two (2) outside air temperature sensors and two (2) outside air humidity sensors are to be provided as general inputs to the BMS system. The pair of readings shall be averaged for use by the system. If an individual reading is found to be out of range by comparison, then the other reading shall be used, and an alarm shall be generated.

H. Where the normal sequence position or status of a device is allowed to be manually over-ridden by the building Owner/operator, the device shall be returned to its normal "system off" position, if the system is shut down by the BMS system or building fire alarm system. This includes overriding manually set and locked setpoints. Upon system restart, the device shall return to its manually over-ridden status. Returning devices to their normal "systems off" position shall be done to reduce the potential of damage to the systems.

3.07 CONTROL SEQUENCE

A. Refer to plans for control diagrams, sequences and points lists.

END OF SECTION

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SECTION 23 20 10
PIPING SYSTEMS AND ACCESSORIES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 078413 - Penetration Firestop Systems.

1.03 SUBMITTALS

A. Schedule of pipe materials, fittings and connections.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All adhesives, sealants, primers and paint used for piping in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.02 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, Schedule 40 weight; black or galvanized finish as called for; ends chamfered for welding connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type, chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets", or "Sockolets" are acceptable. Socket weld type, 2000 psi wp, where required.

2. Threaded Fittings: Cast or malleable iron, black or galvanized, as required; drainage type where called for.

C. Flanges, Unions and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron, 150 or 300 lb. wwp, based on system pressure. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type.

b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents and working temperatures and pressures. ASME B16.21, nonmetallic, flat, asbestos free, 1/8 in. maximum thickness unless thickness or specific material is indicated.

c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections. Made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

| ELBOW SIZE | SUPPORT SIZE | BASE PLATE |
|---|---|---|
| 2 in. to 3 in. | 1-1/4 in. | 6 in. x 6 in. x 1/4 in. |
| 4 in. to 6 in. | 2-1/2 in. | 8 in. x 8 in. x 1/4 in. |
| 8 in. and larger | 6 in. | 14 in. x 14 in. x 5/16 in. |

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.03 COPPER TUBE AND FITTINGS - SOLDER JOINT

A. Pipe: ASTM B88; Type K, L or M, hard temper. Soft temper only where specified. Plans show copper tube sizes.

B. Tees, Elbows, Reducers: Wrought copper, ANSI B16.22 or cast bronze; ANSI B16.8 solder end connections.

C. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel.

E. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Willard Industries "Solder Safe (silver bearing), Canfield "Watersafe" or approved equal.

2.04 STAINLESS STEEL PIPE AND FITTINGS - PRESSURE-SEALED JOINTS

A. Pipe: Type 304/304L, Schedule 10S, stainless steel conforming to ASTM A312 with plain ends.

B. Couplings and fittings shall be formed of precision cold drawn stainless steel pipe with synthetic rubber O-ring seals.

C. O-ring seals shall be molded of synthetic rubber, Grade HNBR suitable for potable water up to 210°F or Grade EPDM suitable for water up to 250°F.

D. Fitting ends shall be pressed onto pipe using only a tool specifically designed for this purpose. Pipe ends must be fully inserted into the coupling and fitting housing up to the pipe stop. 500 psig maximum CWP rating.

E. Fittings: Elbows, tees, laterals, reducers, adapters as required. Same construction as couplings.

F. Design Basis: Victaulic Vic Press 316, Shurjoint, Viega Pro Press Stainless.

2.05 COPPER DRAINAGE TUBE AND FITTINGS - SOLDER JOINT

A. Pipe: ASTM B306, Type DWV, hard temper.

B. Fittings: Wrought copper, ANSI B16.29 or cast bronze, ANSI B16.23; solder end connections.

C. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.

D. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Canfield "Watersafe" or approved equal.

2.06 COPPER TUBE AND FITTINGS - BRAZED JOINT

A. Pipe: ASTM B88, Type K or L, hard temper.

B. Tees, Elbows and Reducers: Wrought copper, ANSI B16.22 or cast bronze, ANSI B16.18.

C. Unions and Flanges: Unions for 2 in. and smaller. Brazed type cast bronze ground joint, 150 lb. swp; flanged for 2-1/2 in. and larger, brazed type, cast bronze, companion type, gasketed and bolted, ASME drilled 150 lb. swp.

D. Brazing Materials: Class BcuP-2 for brazing copper to brass, bronze or copper. Harris, Inc. Stay-Silv 0, The Prince & IZane Companies Phoscopper O, Lenox WS 78161 or approved equal.

2.07 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Waterway Fittings: 300 psi maximum working pressure at 230°F, male threaded or grooved ends, electroplated ductile iron or steel body with LTHS high temperature polyolefin polymer liner.

E. Make: EPCO, Capitol Manufacturing, Watts, Victaulic, or approved equal.

F. The use of brass valves, brass nipples (3 in. and larger) and Shurjoint epoxy coated transition coupling may be used for dielectric isolation. Dielectric transition fittings for sizes 2 in. through 8 in., which shall provide effective insulation between the steel and copper systems to avoid galvanic local cell and stray current problems. The dielectric transition fitting shall be made of ductile iron per ASTM A536 Gr. 65-45-12, electric deposition coated, with a virgin PP (propylene) lining.

2.08 REFRIGERATION PIPING

A. Type L hard temper deoxidized, dehydrated, and sealed copper tubing, refrigerant grade.

B. Refrigerant grade wrought copper fittings. Long radius elbows.

C. Factory made suction traps.

D. Piping and system shall meet the requirements of Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15-1994 and ASME/ANSI B31.5.

E. Make: Mueller, Howell Metal, Cerro, Cambridge-Lee, Universal Tube.

2.09 HANGERS, INSERTS, AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing, Anvil, Hilti.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
3. Adjustable steel clevis type for 4 in, and larger, and where insulation passes through hanger.
4. Hangers sized to permit passage of insulation through the hanger for refrigerant piping.
5. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.

C. Hanger Shields:

1. Pre-Insulated Type:
   a. Insulated pipes shall be protected at point of support by a 360° insert of high density, 100 psi waterproof calcium silicate, encased in a 180° sheet metal shield. Insulation insert to be same thickness as adjoining pipe insulation and extend 1 in. beyond sheet metal shield. Insulation shall be provided with a factory installed ASJ.
2. Field-Insulated Type:
   a. #18 USSG, galvanized steel shields, minimum 120° arc. Provide high density block, 18# density molded fiberglass inserts, between pipe and hanger shield to maintain proper spacing for insulation. Insulation inserts shall extend 1 in. beyond the sheet metal shields. Material shall comply with ASTM E84 25/50, have a thermal conductivity of K=.30 (stable) and have a service temperature of -120°F to +650°F. Install in accordance with manufacturer's printed instructions.
3. Shield Sizing:

| PIPE SIZE | SHIELD LENGTH | MINIMUM GAUGE |
|---|---|---|
| 1/2 in. to 3-1/2 in. | 9 in. | 20 |
| 4 in. | 9 in. | 20 |
| 5 in. and 6 in. | 9 in. | 20 |
| 8 in. to 12 in. | 12 in. | 18 |
| 14 in. to 24 in. | 18 in. | 16 |

4. Hanger shield gauges listed are for use with band type hangers only. For point loading (roller support), increase shield thickness by one gauge, and length by 50%.

D. Hanger Spacing Schedules: (Based upon most stringent requirement of MCNYS and ASME B31.9)

| COPPER OR PLASTIC PIPE SIZE | COPPER PIPE HANGER SPACING | PLASTIC PIPE HANGER SPACING | HANGER ROD SIZE |
|---|---|---|---|
| 3/4 to 1 in. | 6 ft. | 3 ft. | 3/8 in. |
| 1-1/4 in. | 6 ft. | 4 ft. | 3/8 in. |
| 1-1/2 to 2 in. | 8 ft. | 4 ft. | 3/8 in. |
| 2-1/2 to 4 in. | 10 ft. | 4 ft. | 1/2 in. |
| 5 in. and larger | 10 ft. | 4 ft. | 3/4 in. |

| STEEL PIPE SIZE | STEEL PIPE HANGER SPACING | HANGER ROD SIZE |
|---|---|---|
| 3/4 to 1 in. | 8 ft. | 3/8 in. |
| 1-1/4 in. | 10 ft. | 3/8 in. |
| 1-1/2 to 2-1/2 in. | 12 ft. | 3/8 in. |
| 3 to 4 in. | 12 ft. | 1/2 in. |
| 5 in. and larger | 12 ft. | 3/4 in. |

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1,300 lbs., for 3/8 in. to 3/4 in. rod sizes. Drill through decking for hanger rods and secure devices with integral support plate strap with sheet metal screws. Devices shall have a safety factor of four.

F. Beam Attachments:

1. C-Clamp, locknut, electroplated finish, UL listed, FM approved, for pipe sizes 2 in. and smaller.
2. Center load style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.
3. Welded beam attachments may be considered only upon the review and acceptance of the structural engineer of record with written confirmation of weld meet configuration, location and service/pipe size submitted to the Mechanical Engineer for review.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For Weights Under 1000 lbs.: Insert, "U" shaped channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flush plate welded to top of rod or provide additional inserts and hangers to reduce load per hanger below 1000 lbs.
4. Make: Hilti, ITW Ramset, Phillips "Red Head", or approved equal.

H. Trapeze Hangers:

1. For use on 1-1/2 in. and smaller piping only.
2. Hangers shall be supported with rod sized with a safety factor of four.
3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.
4. Securely fasten piping to trapeze with "U" bolt or straps, dissimilar metals shall not touch, use isolation gaskets.
5. Make: B-Line, Kindorf, Unistrut, or approved equal.

2.10 PIPING ACCESSORIES

A. Escutcheon Plates: Provide escutcheon plates on uninsulated piping in exposed and finished areas. Steel or cast brass polished chrome, split hinge type with setscrew, high plates where required for extended sleeves.

B. Pipe Guides: Cylindrical steel guide sleeve, proper length for travel, integral bottom base anchor, top half removable. Split steel spider to bolt to pipe, copper plated spider for copper pipe. Insulated style where pipe is required to be insulated. Make: Tri-State Industries, or equal.

C. Anchors:

1. Pipe support; same material as pipe; as manufactured by Pipe Shields Model C1000 or C2000, Keflex, Metraflex, Flexonics or Advanced Thermal Systems.
2. Pipe Anchors:
   a. Anchors shall be designed and located as to prevent stress to piping or building structural components from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stressing to connected equipment.

D. Pipe Roll Stand: Cast iron roll stand. Make: Advanced Thermal Systems, Carpenter and Patterson, ITT Grinnell, Pipe Shields.

## 2.11 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves shall be used for sleeves in horizontal and vertical applications through structural surfaces. Sleeves shall extend a minimum of 1 in. beyond both sides of the structure surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping installation or requirements of the sealing element manufacturer.
2. Full circle water stop collar for sleeves located in below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
3. Schedule 40, PVC sleeves or sheet metal sleeves for nonstructural surfaces. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing. Sleeves shall extend a minimum of 1/2 in. beyond both sides of the non-structural vertical surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping.

B. Pre-Insulated Type:

1. Adjustable or fixed length metal cans, 24 gauge minimum sized for 1 in. spacing between insulation and can. Insulation shall consist of a 360° waterproofed calcium silicate insert sized to extend 1 in. beyond wall or floor penetration. Calcium silicate insert shall be the same thickness as adjoining pipe insulation. Spacing between shield and can packed at each end with double neoprene rope positively fastened.

## 2.12 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Make: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

B. Waterproof Type:

1. Exterior Walls, Below Grade, Above Floor: Synthetic rubber material with zinc plated bolts. Make: "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

## 2.13 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (HVAC) piping.

## PART 3 - EXECUTION

3.01 EQUIPMENT AND SYSTEMS

A. Provide equipment and systems in accordance with laws, codes, and provisions of each applicable section of these specifications. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing (except where specifically called for), making proper allowance for expansion and anchoring. Arrange piping at equipment with necessary offsets, union, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Install drains consisting of a tee fitting with a 3/4 in. ball valve with hose end cap and chain, at low points in hydronic piping system mains, and elsewhere as required for system drainage.

B. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings unless submitted and accepted per Part 2. Do not install valves, union and flanges in inaccessible locations. Provide trap seal of adequate depth on drain pans.

C. Provide reducers at all control valves, where control valve is smaller than pipeline size. Reducers for steam control valves shall be eccentric type. Provide unions at each side of every control valve and reducers directly adjacent to the unions.

D. Provide reducers at all balance valves, where balance valve is smaller than pipeline size.

3.02 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3 ft. to 9 ft. depending on the voltage.

3.03 WATER AND GLYCOL SYSTEMS

A. Top connection for upfeed, bottom or side connection for downfeed. Grade off level; up in direction of flow and down toward drain.

3.04 REFRIGERATION PIPING

A. Fittings brazed with silver brazing alloy. Guarantee refrigerant charge for one year from date of final acceptance. Provide for flexibility at compressor connections. Piping and system shall meet the requirements of Mechanical Refrigeration Safety Code, ANSI B9.1. Clean piping, then pump-down and evacuate system to 0.1 in. VAC break vacuum with dry nitrogen and re-evacuate to 0.1 in. VAC and hold for four (4) hours; then charge system. Charge with refrigerant as recommended by manufacturer.

3.05 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, or from other piping. Support each pipe with individual hangers from concrete inserts, welded supports, or beam clamps of proper configuration and point loading design requirements for each location including the designated safety factor. Trapeze hangers are acceptable for racking of multiple pipes of 1-1/2 in. or less in size. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size as called for, using four nuts per rod. Provide additional rustproofed structural steel members, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Only concentric type hangers are permissible on piping larger than 2-1/2 in., "C" types are permitted for piping 2-1/2 in. and smaller. Provide riser clamps for each riser at each floor.

B. Provide a pipe hanger within 12 in. of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.06 HANGERS ATTACHED TO JOISTS

A. Individual hangers may be suspended directly from the bottom chord panel point provided that the sum of the concentrated loads within the chord panel does not exceed 100 pounds and the attachments are concentric to the chord. (Eccentrically loaded joists using beam clamps or other attachment methods are not acceptable.)

B. For nominal concentrated loads between panel chords, which have been accounted for in the specified uniform design load for the joists, this Contractor is to provide struts to transfer the load to a panel point on the opposite chord as reviewed and acceptable by the Structural Engineer of Record.

3.07 PIPE CONNECTIONS

A. Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat. "Walseal" fittings may be used; if sufficient alloy is showing, face braze such joints.

C. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specific for each application.

D. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Dielectric Pipe Fittings: Provide dielectric protection devices at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all piping systems. Dielectric protection systems are not required for air or gas systems.

3.08 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. When welding galvanized pipe, apply cold galvanizing on joint after welding.

3.09 HANGER SHIELDS

A. Provide at hangers for refrigerant piping. Pre-insulated type or field-insulated type at Contractor's option.

3.10 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors which are core-drilled, except where floor is waterproofed.

B. Pre-Insulated Type: Required for refrigerant piping.

C. Standard Type: Provide for piping, except as called for.

D. Extend 1/8 in. above finished areas. In above grade mechanical and other areas with floor drains; use steel pipe sleeves 2 in. above floor. Use pipe sleeves in bearing walls, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber

grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.11 ANCHORS

A. Provide piping system anchors where shown on the plans, and as recommended by the expansion joint/loop manufacturer. Where an anchor is shown at a change in piping direction, it shall fully control movement in both directions. In lieu of a single anchor fabricated for two directional control, two (2) individual anchors may be provided. Provide detailed fabrication drawings for all field-fabricated anchors.

B. Design anchors and equipment and piping supports including comprehensive structural engineering analysis by a qualified professional engineer, licensed to practice in the State of New York using the performance and design criteria specific to this project.

3.12 ALIGNMENT GUIDES

A. Provide alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two (2) or more guide(s) on each side of flexible expansion loop. Install guides nearest to expansion joint not more than four (4) pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

3.13 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior Locations: Firmly pack with fiberglass and caulk.
2. Exterior Walls and Below Grade Cored Holes: Use sealing element.
3. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
4. Waterproofed Walls and Floors: Use waterproof sealing element, device, or compound.

3.14 ESCUTCHEON PLATES

A. Provide polished chrome escutcheon plates for uninsulated exposed piping passing through floors, walls or ceilings in finished areas.

3.15 CLEANING HOT WATER AND GLYCOL SYSTEMS

A. Provide the services of an experienced Water Treatment Subcontractor.

B. After each closed system has been tested and thoroughly flushed, the entire piping system shall be cleaned by, or as per, the Water Treatment Subcontractor.

C. Operate pumps and arrange control system so that all control valves are open. Fill, vent and circulate system with this solution, while rising to design temperature.

D. Remove, clean and/or replace air vents, strainers, and check valves, which do not function properly. After cleaning strainers, circulate for additional time, then clean strainers again; repeat until strainers are found clean. Drain and refill system.

E. Pumps shall not be operated continuously until system is flushed, strainers cleaned and water treatment is complete.

F. Water Treatment:

1. After system cleaning, furnish report of water test to determine quality.
2. Provide complete glycol treatment facilities to Owner, including glycol analysis, feed equipment, metering equipment, pumps, and chemical, obtained from Calgon, Vulcan, Bird Archer, Heating Economy Service, Inc., Mogul, Garratt-Callahan Company, Metropolitan, or Allen-Murray.
3. Recommendations for glycol treatment reviewed by Owner's Representative before systems are placed into service.
4. Add glycol treatment as necessary to prevent deterioration of piping system, glycol deterioration and equipment due to oxygen, acid, scaling, etc.
5. Water treatments shall be deemed complete when circulation has been established throughout, and glycol runs clear and clean from deposits and discoloration. Submit typewritten letter to inform Engineer upon completion of the Work.
6. Once water has been run clean, water to be drained and 40% propylene glycol solution to be added to the system.

3.16 TESTS

A. Test piping and accessories before insulation, or concealment. Repeat as many times as necessary to prove tight system. Notify Owner's Representative at least seven days in advance of each test. Isolate valves and equipment not capable of withstanding test pressures. Make leaks tight; no caulking permitted. Remove and replace defective fittings, pipe or connections. Furnish necessary pumps, gauges, equipment, piping, valving, power and labor for testing. Certify that tests have been successfully completed.

B. Schedule of Test Requirements:

1. Hot,Glycol, Water: Hydrostatic, 100 psig at high point of system; two (2) hours duration.

2. Refrigeration:
   a. After installation, charge system with dry nitrogen to end equipment manufacturer's recommended pressure.
   b. System shall hold this charge with no pressure drop for 24 hours.
3. Gas Piping: Test with air to a maximum test pressure of 50 psi for 2 in. and smaller piping, 30 psi for 2-1/2 in. and larger piping for two (2) hour duration and as required by local utility purveyor. Provide a pressure relief valve in the system set for 10 psi more than the test pressure.
4. Compressed Air Piping (Other than Temperature Controls): Test with air to a maximum test pressure of 1.5x working pressure or 100 psi, whichever is fewer, two (2) hour duration. Provide a pressure relief valve in the system being tested set for 10% more than the test pressure.
5. Test: No change in pressure under stable temperature conditions.
6. Equipment: Test at working pressures.

## 3.17 PROTECTION AGAINST PHYSICAL DAMAGE

A. In concealed locations where piping, other than cast-iron or steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 in. from the nearest edge of the member, the pipe shall be protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 in. (No. 16 gage) shall cover the area of the pipe where the member is notched or bored, and shall extend note less than 2 in. above sole plates and below top plates.

## 3.18 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe sizing changes made only as reviewed by Engineer. Where discrepancy in size occurs, the larger size shall be provided.

## EXHIBIT "A" - PIPING MATERIALS (HVAC)

(Note at end of Exhibit "A")

| SERVICE | PIPE MATERIALS | FITTINGS | CONNECTIONS |
|---|---|---|---|
| Hot water heating | Schedule 40, black steel | Malleable iron and butt weld | Screwed 2 in. and smaller; Welded 2-1/2 in. and larger; (SEE NOTE 1) |
| Hot water heating (optional) | Type L copper | Wrought copper or cast bronze, solder end | No-lead solder for 2 in. and smaller; 95/5 for 2-1/2 in. and larger |
| Refrigerant | Type L refrigerant grade hard temper, deoxidized copper | Wrought copper, solder end | Sil-Flo "5" silver brazing |
| Vent, overflow, drain | Schedule 40, galvanized steel or Type M copper | Cast iron drainage type or wrought copper | Threaded or solder |
| Glycol | Schedule 40, black steel | 2000# forged steel or cast iron for screwed; butt weld fittings for welded or flanged | 2-1/2 in. and larger butt welded or flanged; 2 in. and smaller screwed or socket welded (SEE NOTE 1) |
| Glycol (optional) | Type L copper | Wrought copper | No-lead solder |
| Domestic water | Type L copper | Solder end | No-lead solder |
| Natural gas and gas vent | Schedule 40, black steel | Butt weld, 2-1/2 in. and larger; Screwed 2 in. and smaller; 150# | Welded or screwed; provide adequate drip, scale pockets |
| Snow melting and radiant floor | SEE "RADIANT FLOOR AND SNOW MELTING SYSTEM SECTION 238316.11 | | |
| Water treatment (max. 100 psi up) | Schedule 80, PVC | Socket type PVC | Solvent welding |

NOTES FOR EXHIBIT "A":

NOTE 1: Screwed piping permitted in Crawl Spaces, Mechanical Rooms and Boiler Rooms.

END OF SECTION

SECTION 23 21 10
WATER SYSTEMS SPECIALTIES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Submit product data on water system specialties.

1.03 GENERAL REQUIREMENTS

A. Equipment and accessories shall be rated for a minimum of 125 psi wwp, and 250°F temperatures. Manufacturer's written installation procedures shall become a part of these specifications.

## PART 2 - PRODUCTS

2.01 AIR SEPARATOR

A. The air separator shall have an internal stainless steel air collector tube with 5/32 in. diameter perforations and 63% open area designed to direct accumulated air to the compression tank or air vent via an NPT vent connection at top of unit.

B. The air separator shall have a removable galvanized steel system strainer with 3/16 in. diameter perforations and a free area of not less than five times the cross-sectional area of the connecting pipe. The strainer shall be located at the bottom of the vessel to reduce floor space required for strainer removal.

C. A blowdown connection shall be provided to facilitate routine cleaning of the strainer and the separator.

D. Vessel shell diameter to be three times the nominal inlet/outlet pipe diameter, with a minimum vessel volume for sufficient velocity reduction. The air separator must be designed, constructed and stamped for 125 psig at 350°F in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator(s) shall be painted with one (1) shop coat of air dry enamel.

E. A manufacturer's Data Report for Pressure Vessels, Form U-1 as required by the provisions of the ASME Boiler and Pressure Vessel Code, shall be furnished for each air separator upon request.

F. The air separator shall be sized for a maximum pressure drop of 2 ft. wg. at full system flow rate, but the inlet air outlets sizes shall not be smaller than the line size as shown on drawings.

G. Designer Equipment: Bell & Gossett.

H. Manufacturer: Armstrong, Bell & Gossett, Taco, Thrush, John Woods Co.

2.02 PRESSURIZED EXPANSION TANKS AND ACCESSORIES

A. Steel tanks, 125 psi wwp, ASME construction, with reinforced opening of size and location as required. Red oxide coating outside and final exterior coat of paint; factory applied. Heavy duty butyl rubber removable bladder. Full acceptance vessel. Maximum operating temperature of 240°F. Provide ring stand.

B. Design Equipment: Taco.

C. Manufacturers: Armstrong, Bell & Gossett, Taco, Thrush.

2.03 HYDRONIC BUFFER TANKS AND ACCESSORIES

A. Steel tanks, 125 psi wwp, ASME construction, with four (4) 4" flanged openings. Red oxide coating outside and final exterior coat of paint; factory applied. Automatic air vent on top. 2" HCFC Free foam insulation with painted metal jacket. Maximum operating temperature of 240°F. Provide ring stand and lifting lugs.

B. Accessories:

1. Temperature gauge
2. Pressure gauge
3. Manway
4. 1" bottom drain
5. (2) Two 3/4" tapings with plugs at 18" and 40" from bottom of tank

C. Design Equipment: Lochivar.

D. Manufacturers: Lochivar, Cemline, Taco, Wessels.

2.04 RELIEF VALVES

A. To relieve full heating capacity.

B. Provide an ASME labeled safety relief valve as called for on the plans/details.

C. Manufacturer: ITT, Bell & Gossett, Watts, Kunkle, Spence, Keckley.

2.05 FLOW BALANCERS

A. Balancing and flow meter stations suitable for use on heating and cooling systems. Constructed for 125 psi and 250°F.

B. Provide one 0-35 FT HD range meter complete with hoses, shut-off valves, and vent valves, and deliver to Owner and obtain receipt. 6 in. and Smaller: Calibrated balance valve with provisions for connecting a portable differential pressure meter. Flow balancer is to be suitable as a service valve. Meter connections to have built-in check valves. An integral pointer shall register degree of valve openings. Valve shall have internal seals.

1. Balance valve sizes shall be based upon gpm range rather than pipe size.

| **Balance Valve Size** | **GPM Range** |
|---|---|
| 1/2 in. | Up to 2.5 |
| 3/4 in. | 2.5 - 4.5 |
| 1 in. | 4.5 - 10 |
| 1-1/4 in. | 10 - 15 |
| 1-1/2 in. | 15 - 30 |
| 2 in. | 30 - 60 |
| 2-1/2 in. | 60 - 100 |
| 3 in. | 100 - 180 |
| 4 in. | 180 - 300 |
| 5 in. | 300 - 450 |
| 6 in. | 450 - 600 |

2. Design Equipment: Bell & Gossett "Circuit Setter".
3. Manufacturers: Bell & Gossett, Armstrong, Taco, Tour & Anderson, Oventrop Hydrocontrol, Watts.

2.06 STRAINERS

A. Cast semi-steel body or cast iron construction for steel piping and bronze body construction for copper piping; equipped with removable, monel or stainless steel water screen; maximum pressure drop 2 psi with free area at least four times area of pipe. Provided with blow-off outlet.

B. Sizes 5 in. and Smaller, Y-Pattern Strainer: 125 psig working pressure; flanged ends for NPS 2-1/2 in. and larger, threaded connections for NPS 2 in. and smaller, bolted cover, perforated stainless steel basket and bottom drain connection.

C. Sizes 6 in. and Larger, Basket Strainer: 125 psig working pressure; flanged end connections, bolted cover, perforated stainless steel basket and bottom drain connection.

D. Design Equipment: Mueller.

E. Manufacturers: Elliott, Keckley, Mueller, Webster, Watts, Spirax-Sarco.

2.07 TRIPLE DUTY VALVE

A. Provide as shown on plans, a straight, angle or straight-angle pattern valve designed to perform the functions of a center guided nonslam check valve, shutoff valve and calibrated balancing valve.

B. 2 in. and Smaller: The valve shall be of brass construction with connections per ANSI B1.20.1-83 suitable for 200 psi working pressure for operation temperatures up to 250°F. The valve shall be fitted with a chrome plated brass ball, glass and carbon filled PTFE seating rings, EPDM seals and brass stem. Check valve to have chatter preventing stainless steel sprint and EPDM seals.

C. 2 in. and Larger: The valve shall be of heavy-duty cast iron (NPT and flanged models only) construction with connections per ANSI B1.20.1-83 suitable for 175 psi working pressure for operating temperatures up to 250°F. The valve shall be fitted with a bronze seat, replaceable bronze disc with EPDM seat insert or stainless steel stem, and chatter preventing stainless steel spring. The valve design shall permit repacking under full system pressure.

D. Cv rating shall be provided at every 10% increment opening for the straight and angle valve. Manufacturer shall supply the Cv rating for read-out of flow determination and system pressure drop.

E. The valve shall be equipped with brass readout valves (with integral check valve) to facilitate taking differential pressure readings across the orifice for accurate system balance. The valve shall be produced at an ISO 9001 approved facility.

F. Triple duty valve sizes shall be based upon gpm range rather than pipe size. The valve shall be capable of system flow at the lowest open flow pressure drop. Submit performance chart for system balancing for each valve indicating design flow and minimum and maximum turn-down pressure drops.

G. Design Equipment: Bell & Gossett 3DV (2 in. and smaller) or 3DS (2 in. and larger).

H. Manufacturers: Armstrong Flo-Trex, Bell & Gossett, Taco plus Two, Grundfos, Thrush.

2.08 AIR VENTS

A. Manual air vents shall be a 3/4 in. ball valve with bronze body, nickel plated bronze ball, hose end, cap and chain, Watts B6000CC, PurgenVent M7910MAV, Nibco 1905.

B. Automatic air vents shall be float type, 35 psig rated, Armstrong No. 502CV OR float type, 150 psig rated, Armstrong No. 75, Spirothern, Taco tty-vent. Spirotop. Provide unit with an appropriate rating, as necessary for location.

C. High Capacity Automatic Air Vent:

1. Cast iron body. 150 psig rated. Stainless steel float.

2.09 GLYCOL MAKE-UP SYSTEM

A. Provide the following apparatus including all external piping and wiring:

1. One (1) fifty gallon polyethylene solution tank, with cover, mounted in a welded steel frame. Frame shall be furnished with an epoxy coating to resist chemical attack.
2. One (1) close coupled pump, rotary gear type, bronze construction with stainless steel shaft, internal pressure relief valve. Motor shall be 1/2 HP, 115 VAC, 60 Hz at 1,725 RPM. Pump shall be capable of delivering 1.7 GPM at 70 psi. Pump to be mounted under the tank and pre-piped at the factory.
3. One (1) low level cut-off and alarm shall be mounted on the tank.

B. One (1) pressure switch to activate glycol pump on descending pressure. Pressure switch shall be 5-65 psi range with an adjustable differential of 10-30 psi.

C. Manufacturers: Wessels Series GMP, Armstrong GLA, Neptune Glycol Feeder, or equal.

2.10 GLYCOL SOLUTION

A. The closed loop system shall contain a preblended solution of industrially inhibited propylene glycol and deionized water. The solution percent concentration shall be 40% by volume resulting in freeze (slush) protection to -3°F or lower, and burst protection to -35°F or lower.

B. The water used for the dilution of the glycol must meet the following water quality criteria: <25 ppm Sulfate; <25 ppm Chloride; <1 ppm Calcium; <1 ppm magnesium; <25 ppm Silica. Electrical conductivity umho/cm @ 25 C. 1.0 max. Total water hardness must be less than 60 ppm and meet the Type II Reagent Water Specification as per ASTM D-1193.

C. The selected coolant must meet or exceed the ASTM D-1384 corrosion test for coolants in glassware @ 190°F for 336 hours. The supplier prior to delivery must provide a Certificate of Assurance.

D. The solution shall contain a fluorescent dye to facilitate easy leak detection.

E. Approved Coolant Manufacturers are:

1. Interstate Chemical Company INTERCOOL NFP - Propylene Glycol.
2. Dow Chemical Company Dowfrost HD - Propylene Glycol.
3. Interstate Chemical Company INTERCOOL NFP 50 AA and NFP-40 AA (For boilers and other equipment with aluminum alloy heat exchangers).

## PART 3 - EXECUTION

### 3.01 GENERAL REQUIREMENTS

A. Obtain detailed instructions from each manufacturer for proper method of installation.

### 3.02 SYSTEM FILLING

A. After cleaning, fill each system from low point.

B. With pumps off, vent mains, risers, run-outs, and units, working consecutively from low to high point of building. Obtain approximately 5 psi at highest point. Obtain proper air cushion in compression/expansion tanks.

### 3.03 AIR VENTING

A. Provide where specifically called for in piping details and at all points in piping systems where air may collect due to changes in piping elevation.

1. Manual air vent assembly consisting of 1-1/4 in. x 4 in. air collection chamber with 3/4 in. hose end ball valve with cap and chain.
2. Automatic air vent with a ball valve for the purpose of isolation and service or replacement.
3. Unless otherwise indicated, automatic air vents shall only be installed in Mechanical Rooms. Pipe high capacity air vent discharge down to floor.

B. Equipment Vents:

1. When equipment is above mains: Connect run-outs or risers to upper quadrant or top of mains. Install vent assembly concealed within enclosure, consisting of 1 in. diameter by 4 in. to 6 in. long air collection chamber with 1/4 in. soft copper tube to manual valve. Mount securely near bottom of enclosure, but not fastened to enclosure. For individual units, radiators, fan convectors and units with return grilled: Provide screwdriver operated manual valve, operated from discharge grille or access door. Drill enclosure and position valve for operating without removing enclosure.
2. When equipment is below mains: Connect piping run-outs or risers to bottom or lower quadrant of mains. Vent assembly not required in unit.

Provide means of purging and draining each unit if required. Use tees instead of ells at low point of run-outs.

3.04 AIR SEPARATOR

A. Provide supports and provide blow-down with hose end drain valve. Hang unit from structure at an elevation low enough to allow for upward pitch of piping to compression tank.

3.05 RELIEF VALVES

A. Hot Water System: Pipe discharge to glycol feeder and place hanger at elbow. Install piping so as not to introduce stress of PRV body.

3.06 STRAINERS

A. Install strainers on supply side of each control valve, pressure reducing valve, solenoid valve, in-line pump and elsewhere as indicated. Install NPS 3/4 in. nipple and ball valve in blowdown connection of strainers NPS 2 in. and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 in.

3.07 FLOW BALANCERS

A. Where flow balancers are smaller than pipe line size, provide reducers directly adjacent to flow balancers.

B. Provide on zone or riser returns, on each hydronic unit and where called for. Meter connection points shall not point downward.

C. On terminal heating and cooling unit details where a shut-off valve is shown in conjunction with the flow balancer (3 in. and smaller), if the Armstrong "CBV" or Tour & Anderson "ST" is used, the shut-off valve may be deleted.

3.08 TRIPLE DUTY VALVES

A. Provide an increaser on discharge side of triple duty valve to match full flow pipe size, if triple duty valve is smaller than line size.

3.09 GLYCOL MAKE-UP SYSTEM

A. Set unit on a 6 in. concrete pad.

B. Pipe all relief valves to solution tank.

C. Install pressure switch in system main piping. Wire switch such that it activates pump when system pressure drops.

## 3.10 GLYCOL SOLUTION

A. The Coolant Manufacturer shall analyze the fluid two (2) times during the warranty period to ensure the glycol water solution continues to provide corrosion protection within industry standards and at no cost to the Owner.

B. No chemical additions shall be made to the glycol water solution until the Coolant Manufacturer has completed an analysis. Should such a chemical addition be required, it will be done in accordance with the recommendations on the analyticals as supplied by the manufacturer.

C. The Contractor shall meter the initial water fill for the purpose of hydrostatic pressure testing and/or system flushing. After completion of this requirement, the water shall be metered out. This will provide the contractor with a precise measure of coolant required to fill the system as well as the amount of water trapped in the system. This process will allow for any adjustments required prior to delivery of the premixed glycol solution and ensure that the solution strength is in compliance with the specification.

D. Should the concentration still require adjustment after the system has been filled and as a result of trapped water, then drain the required amount of fluid from the system and replace it with the same manufacturer's coolant in its concentrated form. Repeat this process until compliance with this specification is achieved.

END OF SECTION

SECTION 23 21 23
PUMPS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required, for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Shop drawings and performance curves, on pumps and pump accessories clearly indicate which equipment is being submitted.

B. Provide catalog information on motors as specified in Section 230513.

## PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Pumps shall be non-overloading over their entire performance range with motors capable of running continuously without undue noise, heating, or sparking. Impellers shall be statically and dynamically balanced. Provide mechanical seals for closed systems, constructed of carbon rings with ceramic mating seat up to 220°F. Provide packing type seals for open systems only. Provide materials suitable for water pressures, temperature and conditions for each application. Provide tapped discharges and suction connections for gauges, vent and drain. Provide factory trimmed impeller if required, to meet initial delivery requirements.

B. Provide the services of a factory service engineer or machinist to check each pump alignment before pump is started, using laser equipment.

2.02 SELECTION CRITERIA

A. Pumps shall be non-overloading over their entire performance ranges, with trimmed impeller as required to meet initial delivery requirements. Pump selection shall not take into account, or infringe on the service factor of the motor.

B. Select pumps at appoint within the maximum efficiency for a given impeller casing combustion. Deviations within 3 percent of maximum efficiency are permissible, provided that the lesser efficiency is not less than the scheduled efficiency.

C. Pumps may not be selected such that the impeller diameter is larger than 90 percent of the published maximum diameter for the casing.

2.03 CIRCULATOR PUMPS

A. The pump shall be a maintenance-free, in-line, single stage, wet rotor type with the motor mounted directly to the pump volute. The pump body shall be constructed of cast iron and rated at 125 psi working pressure. The impeller shall be secured directly to the motor shaft by means of a split cone. The motor shaft shall be constructed of aluminum oxide ceramic and shall be supported by two radial bearings mounted in a bearing plate and rotor can. The pump shall not have a coupling or mechanical seal.

B. Design Equipment: Taco.

C. Make: Taco, Armstrong, Bell & Gossett, Grundfos, Wilo.

2.04 IN-LINE CENTRIFUGAL PUMPS

A. Designed for continuous operation between 40° and 225°F. In-line, close-coupled, single stage, bronze fitted construction. All pump internals shall be capable of being serviced without disturbing piping connections. Replaceable shaft sleeves at the seal or packing. Enclosed type impeller, keyed to the shaft and secured by a locking cap screw. Factory guaranteed operating performance. Pumps used in a variable speed pumping system shall contain couplings suitable for very low and intermittent torque loads.

B. Provide spare seal kit per pump model and turn over to owner.

C. Design Equipment: Taco 1600 Series.

D. Make: Armstrong, Bell & Gossett, Taco, Grundfos CBS, Paco VL, Wilo.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

C. In-line pumps shall be installed using continuous-thread, hanger rods and elastomeric hangers of size required to support weight of in-line pumps.

3.02 ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment services for all pumps that use a coupler attached to the device train, whether base mounted or inline mounted. Alignment shall be accomplished with a laser shaft alignment system.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

E. Provide an alignment report indicating alignment setup data, tolerances and final results.

## 3.03 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.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:
   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.
5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

## 3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION

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SECTION 23 31 00
SHEET METAL AND DUCTWORK ACCESSORIES CONSTRUCTION

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.02 QUALITY ASSURANCE

A. Ductwork shall be fabricated and installed in compliance with latest edition of the following standards.

1. SMACNA Duct Construction Standards - Metal and Flexible Ductwork.
2. SMACNA Duct Liner Application Standard.
3. SMACNA HVAC Air Duct Leakage Test Manual.
4. 2015 International Energy Conservation Code.
5. NFPA Standard 96.
6. Plans and Specifications which exceed the requirements in any of the referenced standards.
7. 2015 International Mechanical Code.

B. All sheet metal shall be fabricated and installed by an experienced Contractor specializing in this type of work.

C. All ductwork and fittings shall have a computer generated label affixed to the exterior surface of each section, detailing all applicable information including the duct dimensions, gauge, reinforcement type/class and connection type by systems manufacturer. Galvanizing thickness shall be clearly stenciled on each duct section.

D. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

1.03 SUBMITTALS

A. Ductwork Shop Drawings.

B. Duct Access Doors.

C. Flexible Duct.

D. Submit a complete shop standard manual including miscellaneous materials, and construction details for all shop fabricated materials including, but not limited to,

volume dampers, turning vanes, duct sealant, equipment flexible connections, access doors, flexible duct, acoustical duct lining, etc.

1.04 GENERAL

A. All adhesives, sealants, primers and paint used for ductwork in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

1.05 DUCTWORK CLASSIFICATION

A. Duct systems are to be classified and constructed per the SMACNA Velocity-Pressure classification system as follows:

1. All ductwork shall be constructed for a minimum pressure class of 2 in. w.g. (unless stated otherwise) for the following systems, as applicable:
   a. Supply duct downstream of terminal units.
   b. Garage low pressure supply ductwork.
   c. Return ductwork.
   d. Low pressure exhaust ductwork.
2. Supply duct upstream of terminal units shall be constructed for a minimum pressure class of 3 in. w.g. unless otherwise stated or required as per below.
3. Lab fume exhaust shall be constructed for minimum pressure class of 3"in w.g.
4. Pressure classes above 3 in. w.g. shall be provided as follows, based upon the external static pressure as scheduled for each specific fan.

| **Scheduled External Static Pressure** | **Pressure Class** |
|---|---|
| Over 3 in. up to 4 in. w.g. | 4 in. w.g. |
| Over 4 in. up to 6 in. w.g. | 6 in. w.g. |
| Over 6 in. up to 10 in. w.g. | 10 in. w.g. |

1.06 DUCTWORK SHOP DRAWINGS

A. Prepare minimum 1/4 in. scale drawings:

1. Detailed ductwork shop drawings shall include size, layouts and pressure classifications. Any ductwork installed without benefit of review by the Engineer of Record may be subject to replacement at the expense of the Contractor.
2. Constructed from actual field inspections and measurements so as to assure a complete job.
3. Incorporate dimensions of actual equipment proposed for use on the project.

4. Showing adequate sections, elevations, and plan views and indicating the bottom of ductwork elevations from the finished floor.

5. Indicating all volume dampers, fire dampers, smoke dampers, damper access doors and other accessories required for a completed project.

B. Call to the attention of the Engineers immediately, any major deviations from the Contract Drawings, which must be made. All deviations shall be documented in writing.

C. Indicate roof, wall and floor opening dimensions and locations shown on shop drawings.

D. Submit prints to each Contractor of the other trades for review for interference's and coordination with their work.

## PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

A. Unless otherwise called for, provide materials in accordance with Exhibit I at the end of this section.

2.02 SQUARE AND RECTANGULAR DUCTWORK

A. Galvanized Sheetmetal: Comply with ASTM A653 and A924, with G90/Z275 coating. Stainless-steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in Exhibit "I"; cold rolled, annealed, sheet. Aluminum sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view. Gauges per SMACNA HVAC Duct Construction Standards, Metal and Flexible.

B. Transverse and longitudinal duct seams reinforcement shall conform to appropriate tables and figures per SMACNA Velocity-Pressure Classification for duct construction.

1. Transverse joints shall be sealed with duct joint sealant. "Ductmate" or "Nexus" 4-bolt connection systems may be used in lieu of standard construction.

2. Field assembled longitudinal seams shall be sealed with duct sealant. Factory or shop fabricated rolled or machine pressed longitudinal seams does not require sealant.

C. Corner closures shall be required as described and illustrated by SMACNA Duct Construction Standards.

D. Throat radius on all elbows shall not be less than the dimension of the duct plane of radius. Where this cannot be maintained, use shorter radius with internal guide vanes, or square elbow with turning vanes.

E. Bracing and hanging of ductwork shall be per SMACNA Standards for size and system class of ductwork being used.

F. Any transformations shall not reduce the ductwork cross-sectional area. Maximum angle in straight duct, 20° for diverging flow and 30° for contraction flow. Transformation from square to round or flat to oval seams welded or brazed.

## 2.03 ROUND DUCTWORK

A. Standard Round Ductwork:

1. Galvanized Sheet metal: Comply with ASTM A653 and A924, with G90/Z275 coating. Stainless-steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in Exhibit "I"; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D or No. 3 as indicated in Exhibit "I". Aluminum sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view. Gauges per SMACNA Duct Construction Standards. Spiral lock-seam or longitudinal fusion-welded.
2. All spiral ducts shall have locked seams so made as to eliminate leakage under pressure for which this system has been designed. Longitudinal seams duct shall have fusion-welded butt seams.
3. No stovepipe will be allowed.
4. Round Ductwork Fittings:
   a. All fittings fabricated per SMACNA Standards for round and flat-oval ductwork, material to match straight pieces of ductwork.
   b. Fittings shall have continuous, welded seams.
   c. 90° tees shall be conical type. 90° tees and 45° laterals up to and including 12 in. diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming. The entrance shall be free of any restrictions.
   d. Round taps off the bottom of rectangular ducts down to diffusers shall be made with a 45° square to round shoe-tap.
5. Elbows:
   a. Diameters 3 in. through 8 in.: Two-section stamped and continuously welded elbows, material to match straight pieces of ductwork.
   b. Over 8 in.: Gored construction with standing seam construction and internally sealed or continuously welded. Less than 35° - two gores, 36° to 71° - three gores, over 71° - five gores.
   c. Fabricated to a centerline radius of 1.5 times the cross-section diameter.

d. Adjustable elbows maybe used for round up to 12 in. diameter in Velocity-Pressure Classes 2 in. w.g. and below. Seal adjustable joints airtight after installation.

6. Joints:

a. For duct construction pressure 3 in. w.g. or greater:

1) Round Joints:

a) Unexposed Duct 3 in. - 30 in. Diameter: Connect round duct with a one piece interior slip coupling, at least two gauges heavier than duct wall, beaded at center and fastener to duct with screws. Seal joint with an approved sealant applied continuously around both end of coupler prior to assembling and after fastening.

b) All Exposed Duct and Unexposed Duct 30 in. - 72 in. Diameter: Install using a three piece, gasket flanged-joint consisting of two internal flanges, with integral mastic sealant, and one external closure band, which compress the gasket between the internal flanges.

(1) Acceptable Manufacturer: Ductmate Industries "Spiralmate" system E-2 Flange by Sheet Metal Connectors Inc., QF Duct Clamp by Nord Fad.

c) Above 72 in. Diameter: Install using companion angle flanged joints as defined in Figure 3-1 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible" Third Edition. Refer to manual for proper sizing and construction details.

b. Pipe-to-pipe joints in diameters up to 60 in. shall be by the use of sleeve couplings, reinforced by rolled beads.

c. Pipe-to-fitting joints in diameters up to 60 in. shall be by slip-fit of projecting collar of the fitting into the pipe.

d. Insertion length of sleeve coupling and fitting collar shall be 2 in. up to 36 in. diameter and 4 in. above 36 in. diameter.

e. Pipe-to-pipe and pipe-to-fitting connections in ductwork above 60 in. in diameter shall be made by angle ring flanges. The flange on the pipe shall be a 2 in. x 2 in. x 3/16 in. angle attached to the pipe with a continuous weld. The fittings shall have a loose ring "Van Stone" flange. A 5/8 in. flange shall be provided to act as a gasketing surface for sealing with the angle ring being a rolled, welded ring 2 in. x 2 in. x 3/16 in. Bolt hole spacing for angle rings shall be 6 in. centers.

f. If longitudinal seam duct greater than 60 in. in diameter is supplied in lengths greater than 4 ft., one angle ring must be welded to the duct on 4 ft. centers for support.

2.04 DUCTWORK SEALING

A. SMACNA Duct Sealing Classification shall be used for duct systems using the following criteria:

1. Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A, as required to meet the requirements of SMACNA Duct Construction Standards and with standard industry practice, including transverse joints, longitudinal seams, fitting connections, and all penetrations of the duct wall.
2. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage. Pressure sensitive tape shall not be used.
3. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels and duct connections to equipment.
4. Sealing that would void product listings is not required.
5. Spiral lock seams need not be sealed.

B. Duct sealant for indoor applications shall be non-fibrated, water based, Hardcast Iron-Grip IG-601, Ductmate PRO Seal, Foster 32-17 or Childers CP146.

C. Duct sealant for outdoor applications shall be fibrated, water based, Hardcast Versa-Grip VG-102, Ductmate Fiberseal, Foster 32-17 or Childers CP148.

D. Sealants and tapes shall be listed and labeled in accordance with UL 181A or UL181B and marked according to type.

2.05 TURNING VANES

A. Provide in mitered elbows as shown on contract drawings. Vanes 36 in. or longer shall be double wall air foil type. All turning vanes shall be installed as per the latest SMACNA Standards. Turning vane size and spacing shall be as per SMACNA. Turning vane spacing greater than SMACNA Standards is not acceptable.

B. Turning vanes shall be Harper, Duro Dyne or Ductmate double wall turning vanes fabricated from the same material as the duct.

C. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vane shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer's instructions.

D. Rails for mounting turning vanes shall have self locking, friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in

Figure 4-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible". Rail systems with non-compliant tab spacing shall not be accepted.

E. Acoustical Turning Vane: Shall be used in applications that require quiet operating systems. Mounting rails shall have friction insert tabs that align the vanes automatically.

F. Acceptable Manufacturer: Ductmate Industries PRO-Rail Turning Vane Duro Dyne Vane Rail, Sheet metal connectors EZ rail.

2.06 DAMPERS IN DUCTWORK

A. Blade Type Volume Dampers: Constructed per SMACNA, one gauge heavier than duct material, securely fastened to 3/8 in. sq., cold rolled steel operator rod. Provide elevated dial regulator for 2 in. insulated ductwork.

B. Multiple Blade Type Volume Dampers: Provide multiple blade volume dampers in ductwork above 12 in. in height.

1. Heavy duty, manual balancing dampers suitable for application in HVAC systems with velocities to 1,500 ft. per minute, open position and max. pressure of 3 in. w.g. close position. Ruskin MD, Greenheck MBD-15, nailor 1820.

2. Fabrication:

a. Frame: 5 in. x minimum 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel.

3. Blades:

a. Style: Single skin with 3 longitudinal grooves.

b. Action: Opposed.

c. Orientation: Horizontal.

d. Material: Minimum 16 gauge equivalent thickness, galvanized steel.

e. Width: Nominal 6 in.

4. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.

5. Linkage: Concealed in frame.

6. Axles: Minimum 1/2 in. diameter, plated steel, hex-shaped, mechanically attached to blade.

7. Control Shaft: 3/8 in. square plated steel.

8. Finish: Mill galvanized.

a. Actuator: Hand quadrant for 3/8 in. square extended shaft.

b. Hand Quadrant Standoff Bracket: 2 in. standoff for insulated ductwork.

c. Oillite bearings.

d. Factory Sleeve: Minimum 20 gauge thickness, minimum 12 in. length.

C. Fire Dampers: See "Fire Dampers" Section.

D. Automatic Air Dampers: Furnished as part of "Building Management System" Section 230923.

E. Blast Gates: Aluminum housing, locking thumbscrew, galvanized slide blade.

2.07 FLEXIBLE AIR DUCTS AND CONNECTORS

A. Flexible air ducts and connectors shall be constructed in compliance with NFPA Bulletin 90A, 90B and UL Standard 181 and shall be listed and labeled as Class I Air Duct.

B. Flexible air ducts and connectors shall be tri-laminate:

1. Consisting of corrosion resistant galvanized steel helix encapsulated by a double lamination of polyethylene or spun bond nylon.

2. Factory applied (R 6.0) fiberglass exterior insulation, sheathed in a seamless, tri-directionally reinforced, metalized polyester, exterior vapor barrier.

3. R-value shall be classified by Underwriters Laboratories, and certified by the Air Diffusion Council, in accordance with ADC Flexible Duct Performance and Installation Standard (1991), using ASTM C-518, at installed wall thickness, on flat insulation only. Comply with ASHRAE/IESNA 90.1.

4. Recommended operating pressure for flexible ductwork shall be three times maximum system press but not less than 6 in. w.g. positive pressure for 4 in. - 20 in. dia., 5 in. wg. negative pressure through 16 in. dia., 1 in. negative pressure for 18 in. and 20 in. dia. Maximum velocity of 5500 fpm.

5. Operating temperature range - 20°F to 250°F, intermittent @1/2 in. pos. w.g. max., -20°F to 140°F, continuous at maximum pressure.

6. Flame Spread: 25 max. smoke developed rating: 50 max.

7. Porous inner core flexible duct shall not be used.

C. Static pressure and thermal performance shall be tested and certified in accordance with Air Diffusion Council (ADC) Test Code FD-72-R1 under conditions of 140°F for 164 hours and 180°F for 4 hours.

D. Acoustical performance shall be certified in accordance with ASTM E 477 and/or Air Diffusion Council Test Code FD-72-R1.

1. Minimum Acoustic Performance:

a. The insertion loss (dB) of a 6 foot length of duct when tested in accordance with ASTM E477 at a velocity of 1000 feet per minute shall be at least:

| | 125 Hz | 250 Hz | 500 Hz | 1000 Hz | 2000 Hz | 4000 Hz |
|---|---|---|---|---|---|---|
| 8 inch dia. | 26 | 27 | 27 | 31 | 32 | 27 |
| 12 inch dia | 22 | 26 | 24 | 31 | 31 | 20 |

E. Friction loss and leakage for flexible duct only shall be certified in accordance with Air Diffusion Council Test Code FD-72-R1. Leakage for connections shall be accordance with UL 181 requirements.

F. Basis-of-Design: Flexmaster 6B (R-6.0) .

G. Acceptable Manufacturers:

1. Dundas-Jafine Type SPC R6.0/ Type SPC R8.0. Hart & Cooley Type F216 (R-6.0)/ Type F218 (R-8.0)
2. Flexible Technologies, Inc. Thermaflex Type M-KE (R-6.0)/ Type M-KE (R-8.0)
3. Atco Rubber Products, Inc. Type 036 (R-6.0)/Type 031 (R-8.0).

2.08 FLEXIBLE CONNECTIONS TO FANS AND EQUIPMENT

A. Basis of Deign: Ventfabrics, Inc.

B. Acceptable Manufacturers: Ductmate Industries, Inc., Duro Dyne Inc., Elgen Manufacturing, Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Materials: Flame-retardant or noncombustible fabrics, water and mildew resistant UL Standard 214.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 in. wide attached to two (2) strips of 2-3/4-in. wide, 0.028-in. thick, galvanized sheet steel or 0.032 in. thick aluminum sheets. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/in. in the warp and 360 lbf/in. in the filling.
3. Service Temperature: Minus 40 to plus 200°F.

G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/in. in the warp and 440 lbf/in. in the filling.
3. Service Temperature: Minus 50 to plus 250°F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lbf/in. in the warp and 340 lbf/in. in the filling.
3. Service Temperature: Minus 67 to plus 500°F.

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 fan discharge and duct.

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. Outdoor 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 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-in. movement at start and stop.

## 2.09 ACCESS DOORS

A. General:

1. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.
2. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.
3. Systems 3 in. w.g. or less shall utilize a hinged, cam, or hinged and cam square framed access door.
4. Systems 4 in. w.g. and above shall utilize a sandwich type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Third Edition.

5. Approved Manufacturer: Ductmate Industries "Sandwich" style door Ruskin ADR, Ward DSA..
6. All access doors shall be continuous piano hinged type, unless noted otherwise.
7. Non-hinged only allowed where clearance to ceiling does not allow a full 90° swing.
8. Double panel insulated type when used in insulated duct.
9. Single panel uninsulated type allowed in un-insulated duct.
10. Pressure rated according to system in which being installed. Door-to-frame and frame-to-duct gasketing.
11. Provide specified Seal Class A or B ductwork sealing around frame, and hand adjust the latch tension for proper seal, on all access doors other than sandwich panel (Ductmate) style.
12. MINIMUM access door size for ducts 12 in. or less in depth is 12 in. x 8 in.
13. MINIMUM access door size for ducts 12 in. to 18 in. in depth is 18 in. x 14 in.
14. MINIMUM access door size for ducts more than 18 in. in depth is 24 in. x 18 in.
15. In ducts which require multiple section fire dampers due to duct size, provide one access door for each fire damper section.
16. Access doors for fire and smoke dampers shall be permanently labeled with 1/2 in. high lettering reading "SMOKE DAMPER" or "FIRE DAMPER".

B. Door Types:

1. Low Pressure Systems (2 in. w.g. pressure class): National Controlled Air ADH-1, Ruskin ADH22, Vent Products 9701, Air Balance FSA-100, Safe Air SAH, Nailor.

2. Medium and High Pressure Systems (3 in. w.g. pressure class and higher):
   a. Rectangular Duct: Ductmate Industries "Ultimate" Style Door. Sheet metal connector hinged access door, Ruskin ADH.
   b. Round Duct: Ductmate Industries Round Sandwich type, Ruskin ADR, Ward DSA. 8 in. x 4 in. for ducts 14 in. and less in diameter. Round Sandwich type 16 in. x 12 in. for ducts more than 14 in. in diameter.
   c. Furnish and install factory supplied protector molding on cut medal edge for all access doors.

## 2.10 CABLE SUSPENSION SYSTEM

A. Ductwork not required to be exterior insulated in exposed installations may be installed using a cable suspension system.

B. Ductwork shall be installed using load rated, stainless steel cable suspension systems. Cables shall be pre-cut lengths, type 316 stainless steel with fused ends, and pre-made end attachments.

C. Cable grips shall be of 316 stainless steel and have an internal tamperproof cable release mechanism.

D. Stress distribution saddles shall be prescribed in addition for the support of rectangular duct on corners as necessary.

E. Hangers shall have a manufacturer's published safe working load and have a 5 to 1 safety factor.

F. Hang and support ductwork as defined in the latest edition of SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible".

G. Adjustable steel cable hanging system consisting of spring loaded, serrated clamping mechanism shall be tested and certified in compliance with all applicable SMACNA standards for upper and lower attachment methods.

   1. All approved systems must be installed using matching components including steel cable, clamping mechanism and hardware approved by the manufacturer for its corresponding load rating. No Substitution of manufacturer's components is permitted.

   2. Approved systems must be installed per the manufacturer's specific instructions and must not exceed the stated working load rating at any point throughout the system.

H. Supports, bar/angle reinforcements, and other products that are not part of the duct that are manufactured of uncoated mild steel shall either be painted with two (2) coats of primer or shall be manufactured of a galvanized equivalent material.

I. Approved Manufacturer: Ductmate Industries "Clutcher" Cable Hanging System or Gripple Inc.

## 2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Heavy cast zinc alloy instrument test port 3/4 height for ductwork with insulation and 2" height for ductwork with insulation.

C. Install duct test holes where required for duct traverse testing and balancing purposes.

## PART 3 - EXECUTION

3.01 REQUIREMENTS

A. Equipment and systems shall be installed in accordance with local and state codes and regulations having jurisdiction. Bracing and hanging of ductwork shall be per SMACNA - HVAC Duct Construction Standard.

B. Install all ductwork concealed and tight to the structure above unless noted otherwise on shop drawings. Fabricate only after the approval of shop drawings, and in locations to avoid interferences. Ductwork installed without approved shop drawings, which requires removal/modification and/or reinstallation due to conflicts or improper installation shall be repaired at no cost to the Owner.

C. Sizes given on contract drawings are inside dimensions.

D. Keep openings continuously closed and sealed with protective plastic wrapping during construction to prevent entrance of dirt and debris.

E. Extend access openings, damper rods and levers, to outside of external insulation make systems airtight.

F. No piping, conduit or other obstruction to airflow is permitted in ductwork.

G. Provide necessary openings, hanger inserts, framing, chases, and recesses, not provided by other trades.

H. Exposed exhaust or return registers and grilles shall be flush with face of duct; exposed supply registers and grilles shall be mounted outside airstream with 45° shoe-tap extension collars.

I. Provide 14 gauge sleeves for ducts passing through Mechanical Room floors. Set sleeves 4 in. above finished floor in Mechanical Rooms, seal watertight to floor.

J. Where a return or exhaust duct is shown to be left open ended, provide hardware mesh screen at opening.

K. Do not utilize flexible ductwork or connection in any way to connect variable or constant volume boxes to ductwork.

L. For duct penetrations of non-rated walls, provide sheet metal angle framing or sheet metal closure panels around the entire perimeter of each duct wall penetration on both sides of the wall, where the gap exceeds 1/4 inch. Where the gap is less than 1/4 inch, the gap may be caulked on both sides of the wall. Non-rated wall penetrations SHALL NOT be fire caulked under any circumstances.

M. For duct penetrations of rated walls, see Specification Section 230500 - Basic Mechanical and Electrical Requirements.

N. Ductwork that is called for to be welded shall be fully welded, continuous around the entire perimeter at all joints/seams, and shall be fully airtight and watertight.

3.02 FLEXIBLE CONNECTIONS

A. Provide flexible connections for the intake and discharge connections of duct connected to fans and air handling equipment.

B. Round connections are to be made with adhesive and metal drawbands with ends tightly bolted.

C. Rectangular connections shall be made with material securely held in grooved seam between flanges. Attach with adhesive and mechanical fasteners on 6 in. centers.

D. Connections shall be made with a minimum of 2 in. space between duct and equipment collars, installed in line, and with 1 in. excess material folded so as not to interfere with airflow through connection.

E. Mechanically fastened and sealed, with specified duct sealant, at duct and equipment connections.

3.03 FLEXIBLE AIR DUCTS AND CONNECTORS

A. "Air duct" applies to conduit or passageway for conveying air to or from heating, cooling, air conditioning or ventilating equipment but not including the plenum as defined in NFPA 90A. "Air connector" applies to conduit for transferring air between an air duct or plenum and an air terminal device or an air inlet or an air outlet as defined by the NFPA 90A.

B. For round to oval connections, provide round-oval flexible adapter.

C. Flexible air ducts and connectors shall be provided in fully extended condition, free from kinks.

D. Flexible air ducts and connectors shall not be used in systems with entering air temperatures in excess of 250°F.

E. Flexible air ducts and connectors shall use only the minimum length required to make the connection and shall be installed in the horizontal or vertical position. Flexible elbows are not acceptable. Do not exceed a maximum length of 36 in., fully extended.

F. Flexible air ducts and connectors shall use minimum 1/2 in. wide positive locking, steel worm drive clamp, or nylon plenum rated straps for joints and connections. One clamp or strap for the inside core liner and one clamp or strap for the outer jacketing. When non-metallic (nylon) straps are used, they should be listed and labeled to standard UL 181B. Fastener package should be marked UL 181 B-C.

G. Collars to which flexible duct is attached shall be beaded and a minimum of 2 in. in length. Wrap twice with UL 181 tape and secure with clamp or strap. Sleeves used for joining two sections of flexible duct shall be beaded and a minimum of 4 in. in length. The draw band shall be positioned behind the bead on the metal collar.

H. Outer vapor barrier and insulation shall be slid over inner core and collar, wrapped twice with UL 181 tape and secured with a clamp or strap.

I. Connections shall be per SMACNA "HVAC Duct Construction Standards - Metal and Flexible", Air Diffusion Council "Flexible Duct Performance and Installation Standards" and NAIMA Installation Standards.

J. Flexible duct shall be supported at manufacturer's recommended intervals, but no greater distance than 2'-6" on center and prior to all 90 degree bends. Maximum permissible sag shall be 1/2 in. per foot of support spacing. Provide a minimum of one hanger on each run of flexible duct.

K. A connection to rigid duct or equipment shall be considered a support joint. Long horizontal duct runs with sharp bends shall have additional supports before and after the bend approximately one duct diameter from the centerline of the bend.

L. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case shall the material contacting the flexible duct be less than 1-1/2 in. wide. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when the manufacturer's recommended procedures are followed.

M. The hanger shall be strapped around the flexible duct and secured to the structure above. Hangers shall not be attached to other mechanical or electrical objects. Hangers may be attached to an approved trapeze. Ceiling grid shall not be used to fabricate a trapeze. Support hangers shall be installed horizontal. Screws shall not be used to penetrate the flexible duct to attach to the hanger.

N. Provide flexible duct connections and splices in accordance with manufacturer's recommended installation instructions.

O. Seal flexible duct connections with sealing materials listed and labeled in accordance with UL 181B. Mechanically secure connections with approved clamping materials.

3.04 TURNING VANES

A. Install only in square elbows of equal dimensions.

B. Install as per latest SMACNA Standards.

C. Secure vane runners to duct with spot welding, riveting or sheet metal screws.

D. When installing in ductwork with internal insulation.

1. Install runners in ductwork inside insulation and bolt through insulation and duct sides, welding bolts to insure rigid installation. Provide build-outs for duct Velocity-Pressure classes above 2 in. w.g.

3.05 DUCT CLEANLINESS AND CLEANING AFTER INSTALLATION

A. Duct Cleanliness:

1. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

2. Prior to shipment to the jobsite, all duct ends and openings must be covered with a heavy duty, dual-ply, clear polyethylene protective film. Open ends are to be kept covered during transport, storage, and installation. As ductwork is installed at the job site, open ends are to be covered to maintain cleanliness.

3. The film must be securely affixed to protect against dirt and debris, and must be translucent to facilitate inspection of interior surfaces without removing the film. The film is have a elongation rating of 600% and a break strength of 13.1 lbs./in. The film shall contain no VOC's, and shall leave no residue on duct after removal.

4. Manufacturer: Ductmate Industries ProGuard (heavy duty grade clear), surface shield duct cover shield, production products, Inc. Profab duct wrap film.

B. Cleaning After Installation:

1. Interior surfaces shall be free of dust and debris prior to initial startup. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. Any cleaning of duct systems shall comply with recommendations of NAIMA and NADCA.

2. Clean external surfaces of foreign substances that might cause corrosion, deterioration of the metal, or where ductwork is to be painted.

3. Clean debris from system before fans are turned on.

4. Keep openings continuously closed during the construction period.

5. Pay damages resulting from dirt blown on painted or other finished surfaces.

6. Repair or replace damaged fan wheels, dampers, or other system parts damaged as a result of debris.

7. Clean system as many times as required until the entire system is dirt free.

## 3.06 INSTALLATION OF ROUND DUCTWORK

A. Use factory-fabricated couplings for joints.

B. After the joint is slipped together, sheet metal screws are placed 1/2 in. from the joint bead for mechanical strength.

C. Sealer is applied to the outside of the joint and covering the screw heads.

D. Flanged joints shall be made with neoprene rubber gaskets.

## 3.07 TEST OF DUCTWORK

A. Conduct duct leakage tests per SMACNA "HVAC Air Duct Leakage Test Manual" and per the requirements of the 2015 International Energy Conservation Code, for all ductwork systems designed to operate at static pressures of 3.0 in. w.g. or greater. Representative sections totaling no less than 25% of the total duct area, per system, for the designated pressure class shall be tested as well as all associated ductwork located out-of-doors. All areas shall be as selected by the Engineer. Positive pressure leakage testing is acceptable for negative pressure ductwork. The rate of air leakage (CL) must be less than or equal to 6 for rectangular duct and 3 for round duct, as determined by equation 4 - 8 in 2015 IECC, which reads: $CL=F/P^{0.65}$ where F = measured leakage rate in CFM per 100 sq. ft. of duct surface, and P = static pressure of the test. When leakage above stated limits occurs, ascertain location of leaks and repair as required. Repeat tests as required to obtain allowable leakage rates. Prepare a report similar to that suggested by SMACNA and submit for review. Duct testing shall be conducted in the presence of the Owner's Representative.

B. Provide test reports indicating pressure tests performed. Include date, section tested, test pressure and leakage rate.

C. Ductwork not required to be tested for leakage, shall be checked and guaranteed to meet the standards of the specified SMACNA Duct Seal Class A. Air balancing and testing shall be used to determine satisfactory operation of duct systems. Balancing reports indicating excessive leakage amounts shall be required to rebuild, repair or seal ductwork having excessive leakage.

## 3.08 DAMPERS AND AIR CONTROL DEVICES

A. Provide volume dampers at all air outlets, diffusers, grilles and as noted on plans. Provide volume dampers at all low pressure supply, return and exhaust, branch ducts and as noted on the plans.

B. Provide dampers necessary to permit proper balancing of air quantities. Comply with code requirements for smoke and fire control. Prevent introduction of uncontrolled outside air into building through roof and wall openings.

C. When dampers are installed in acoustically lined ductwork, install with insulated "build-outs" per SMACNA.

D. Install fire dampers in accordance with "Fire Dampers" Section and applicable codes.

E. Install all dampers furnished as part of "Building Management System" Section.

3.09 ACCESS DOORS

A. Provide for access to upstream side of duct mounted reheat coils, dampers, damper motors, fire dampers, smoke dampers, smoke detectors, control devices, fan bearings, and equipment requiring periodic inspection or service. Provide labels for fire and smoke dampers as called for in Part 2 - Products.

B. For ducts that are too small to install an access door of the minimum specified size, provide a 12 in. long section of removable ductwork for maintenance and inspection access. Removable ductwork shall be fastened between device requiring access and next duct section with duct flanges or duct clamp with PVC foam seal. For ducts that are required to be insulated, provisions shall be made to allow insulation to be easily removed and re-installed.

3.10 DUCT SUPPORTS

A. Provide per SMACNA, same material as duct. Hanger bands to extend down sides and turn under bottom 2 in. Minimum two metal screws per hanger. Angle iron on larger duct spaced per building structural system but not greater that 8 ft. Provide extra support angles as required.

3.11 AIR AND WATERTIGHT DUCTWORK

A. Where water and snow may accumulate on ductwork or where odors or corrosive gasses may collect, ductwork and plenums shall be made watertight by soldering, brazing or welding of joints. Grade ducts down toward waste points and/or toward louvers. Provide valve and drain piping from low point to waste point.

1. Intake and exhaust plenums.
2. Chemical fume hood exhaust.
3. Engine exhaust systems.
4. Chemistry Room exhaust system.

B. Test for Watertightness: Before concealment, apply water by hose to check for leaks, witnessed by Owner's Representative.

3.12 SMOKE DETECTION

A. Smoke detectors shall be furnished by Division 26 "Electrical". Install detectors located in ductwork. Clearly indicate locations of smoke detectors on the sheet metal shop drawings.

B. Increase duct size at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size required with Division 26 "Electrical".

3.13 DUCT SEALING

A. Preparation:

1. Clean surfaces of dirt, oil, grease and loose of foreign matter that could impair adhesion, using soap and water or solvent.
2. Allow surfaces to dry completely before proceeding.

B. Installation of Sealant System:

1. Apply sealant system to duct joints, fasteners, and seams in accordance with manufacturer's instructions.
2. Apply sealant by brush, putty knife or caulk gun, to full coverage. Remove excess adhesive immediately.
3. Completely seal duct joint, fasteners and seams without voids, to a minimum 20 mil thick wet film.
4. Apply and store at ambient temperature of 40°F to 100°F; and protect from freezing until dry.

C. Field Quality Control:

1. Allow duct sealant system to cure a minimum of 72 hours before operating the system.

**EXHIBIT I - DUCTWORK MATERIALS**

| SERVICE | MATERIAL | SPECIAL REQUIREMENTS |
|---|---|---|
| Supply, return, vent, relief, outside and exhaust | Lock forming quality, galvanized steel ASTM A653 and A924, galvaneal/paint grip if not insulated and exposed | Joints and features as called for |
| Exterior ductwork | Galvaneal/paint grip (ready for paint) if not insulated, otherwise same as above | Horizontal top surfaces crossbrocken for positive water drainage, Duct joints, seal Class A, and outdoor duct sealant per spec |
| Fume hood and corrosive exhaust | Type 316 stainless steel | Braze or weld airtight/watertight |
| Accessories, dampers and air turns | Same material and gauge as parent duct | ---------- |
| Field constructed apparatus casings | Galvanized steel ASTM 525 | Sealed airtight |

END OF SECTION 23 31 00

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SECTION 23 33 13
FIRE DAMPERS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services required for the complete installation as shown on the Contract Documents.

1.02 SUBMITTALS

A. Submit product data, types, schedule of sizes, locations, and installation arrangements of all dampers.

B. Submit manufacturer's UL listed installation details for each mounting arrangement.

1.03 QUALIFICATIONS

A. Provide work in accordance with the latest requirements of the Mechanical Code of New York State UL 555, UL 555S and UL555C. Fire dampers shall be Underwriter's Laboratories classified and labeled.

## PART 2 - PRODUCTS

2.01 FIRE DAMPERS

A. Curtain type damper of galvanized steel (304 stainless steel for ductwork containing shower room exhaust, wet location exhaust, and corrosive fume exhaust) construction with fusible link, 20 gauge frame and 24 gauge blades. UL listed and labeled.

1. 100% free area with welded head.
2. Square, rectangular, round or oval duct connection as required by duct connections.
3. 1-1/2 hour rated dampers for walls or floors rated less than three hours. Three-hour rated dampers for three and four hour walls or floors.
4. With factory fabricated sleeve with fixed and slip flanges.
5. Fusible link temperature rating of 165°F. .

B. Design Equipment: Ruskin Model IBD2 Style B.

C. Make: Ruskin, Air Balance, National Controlled Air, Prefco, Venco, Greenheck, Nailor.

## PART 3 - EXECUTION

3.01 LOCATIONS

A. Provide fire dampers in all one, two and three hour rated wall and floor penetrations.

3.02 INSTALLATION

A. Provide sleeve, angles, and access doors for installation in accordance with the latest requirements of SMACNA, NFPA, UL and damper manufacturer.

B. Provide sheet metal access doors with labels, as called for in Specification Section 233100 in ductwork for dampers and accessories.

C. Provide ceiling or wall access doors for dampers and accessories.

D. Install dampers square and free from racking.

E. Do not compress or stretch the damper frame into the duct or opening.

F. Provide bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.

3.03 CERTIFICATION

A. Contractor shall certify that dampers are accessible for servicing, are installed properly, and are operational. Submit three (3) copies of signed certification to the Owner's Representative for review.

3.04 IDENTIFICATION

A. Provide damper tags and charts.
   1. Fasten tag to ductwork adjacent to the dampers.
   2. Number each damper and make chart listing.
      a. Number.
      b. Location.
      c. Air system in which they are installed.

B. Submit three (3) copies of chart to the Owner's Representative for review.

END OF SECTION

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SECTION 23 34 00
FANS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings.

1.02 SUBMITTALS

A. Submit product data for all fans, motors, drives, and accessories. Include all fan curves fan operating point, and sound data.

1.03 QUALITY ASSURANCE

A. Capacity, size and arrangement, static pressure, brake horsepower, component parts and accessories shall be provided as called for or scheduled. Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. The manufacturer shall guarantee sound-power level ratings not exceeding those of the design equipment. All equipment shall be statically and dynamically balanced to acceptable tolerances with weights permanently fastened. Fan wheels shall be rebalanced in the field, if necessary.

B. Pressure Classification:

| Maximum Total Sp | Class |
|---|---|
| Up to 3-3/4 in. WG-STD | I |
| Up to 6-3/4 in. WG-STD | II |
| Up to 12-3/4 in. WG-STD | III |

C. Conventional Motors:

1. Motor sizes shall be as scheduled. Refer to Specification Section 230513 for motor types, efficiency requirements, and acceptable motor manufacturers. All belt-driven fan motors shall be mounted on either an adjustable slide base or a pivoting base.

D. EC Motors:

1. Motors shall be Electronically Commutated Type (EC), variable speed, DC, brushless motors specifically designed for use with single phase, 277 volt (or 120 volt), 60 hertz electrical input.
2. Motor shall be complete with and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator.
3. Motors shall be designed for synchronous rotation. Motor rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in-soft start and soft speed change ramps.

4. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motors shall be direct coupled to the blower.

5. Motor shall maintain a minimum of 85% efficiency over its entire operating range and have a turndown to 20% of full speed, (80% turndown).

6. Provide manual remote fan speed output control for field adjustment of the fan airflow setpoint.

7. Inductors shall be provided to minimize harmonic distortion and line noise.

8. Provide isolation between fan motor assembly and unit casing to eliminate any vibration from the fan to the terminal unit casing.

9. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.

10. The fan manufacturer shall provide a factory installed PWM controller for either manual or DDC controlled fan CFM adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM controller shall be capable of receiving a 0-10 VDC signal from the DDC controller (provided by the controls contractor) to control the fan CFM. When the manual PWM controller is used, the factory shall present the fan CFMs as shown on the schedule.

11. Acceptable Manufacturers: Emerson Ultratech, U.S. Motors-Nidec, GE-ECM, A.O. Smith or equivalent.

E. Drive Systems:

1. Provide fans with belt or direct drive systems as scheduled. V-belt drives as recommended by drive manufacturer, unless otherwise specified or scheduled.

   a. Size drive for 200% of motor rating when motor is 10 HP and larger. Size for 150% of motor rating when motor is less than 10 HP.

   b. Motors 5 HP and larger shall be provided with a minimum of two (2) belts. All belt sets shall be matched.

   c. Cast iron or cast steel pulleys.

   d. Provide belt and shaft guards for each driven device. Provide openings in both the motor and fan sections of the guard so that the motor and fan speeds can be checked without removing the belt guard.

   e. Belts shall be oil and heat resistant, non-static type.

   f. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts.

g. All belt drive fan motor selections must include an allowance for medium drive losses as established by AMCA Publication 203.

F. Motor Pulleys:

1. 5 HP and Smaller: Adjustable type to produce 15% speed change above and below scheduled fan speed. 7-1/2 HP and Larger: Fixed type.
2. 5 HP and Smaller: "A" section, 2.6 in. minimum pitch diameter.
3. 7-1/2 HP to 20 HP: "B" section, 4.6 in. minimum pitch diameter.
4. 25 HP and Larger: "C" section 7.0 in. minimum pitch diameter.
5. Drive ratio not over 4:1.

G. Bearings:

1. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy-duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours as maximum cataloged operating speed.
2. Provide extended lube lines mounted to a bracket located on the fan housing with grease relief fittings on each line. Lube lines shall be exposed copper or Teflon tubing covered with braided stainless steel.

H. Wheels and Propellers:

1. All wheels and propellers shall be balanced in accordance with AMCA Standard 204-96, balance quality and vibration levels for fans. Wheel shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.
2. Blades on all sizes shall be continuously welded to the backplate and deep spun inlet shroud.
3. All hubs shall be keyed and securely attached to the fan shaft.

I. Blower Shafts:

1. All blower shafts shall be AISI-C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum cataloged operating speed.

J. Coating:

1. All steel fan components shall contain an electrostatically applied, baked polyester powder coating. Paint must exceed 1,000-hour salt spray under ASTM B117 test method.

K. Vibration isolation for units shall be furnished by the fan manufacturer unless otherwise noted. Provide rubber in shear type vibration isolators.

L. Certifications:

1. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.
2. All units shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit-tested packaging.

## PART 2 - PRODUCTS

### 2.01 CENTRIFUGAL BLOWER/CENTRIFUGAL VENT SETS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Acme, Cook, Greenheck, New York Blower, Twin City, PennBarry.

B. Centrifugal Blower:

1. Construction:
   a. Fan shall be bolted and welded construction utilizing corrosion resistant fasteners. The scroll wrapper and scroll side panels shall be minimum 12-gauge steel. The entire fan housing shall have continuously welded seams for leak proof operation and shall have a minimum 1-1/4 in. outlet discharge flange.
   b. A performance cut-off shall be furnished to prevent the recirculation of air in the fan housing.
   c. Bearing support shall be minimum 1/4 in. welded steel.
   d. Lifting eyes shall be provided for ease of installation.
   e. High temperature exterior paint.
   f. Fan shall be configured for horizontal discharge.
2. Accessories:
   a. Shaft Cooler.
   b. Heavy duty discharge shutter with counter balance.
   c. Access Door - Bolt.
   d. Drain with cap.
   e. Outlet Screens.
   f. OSHA Belt Guard.
   g. Weather Cover.
   h. Shaft Seal.
   i. Hinged Access Door.
   j. Disconnect Switch - Factory wired and mounted.

3. Flat Blade Wheel:

a. Wheel shall be steel. Non-overloading, centrifugal backward inclined, flat blade type.

b. Basis-of-Design: Product indicated in schedule.

2.02 ROOF FANS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Acme, Cook, Greenheck, Twin City, PennBarry.

B. Spun Aluminum Downblast Centrifugal Exhaust Ventilator:

1. Construction:

a. The fan shall be bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

b. The aluminum base shall have continuously welded curb cap corners for maximum leak protection, and shall be tall enough to cover the wood nailer on roof curb.

c. The discharge baffle shall have a rolled bead for added strength.

d. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.

e. Bearings and drives shall be mounted on a minimum 14-gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream.

f. Hinged at curb so that entire fan can be tilted upward for maintenance, access to dampers, and access to damper motor.

g. 1/2 in. x 1/2 in. aluminum wire mesh bird screen.

2. Wheel:

a. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub.

3. Accessories:

a. Backdraft Damper - Motorized.

b. Roof Curb - In accordance with Section 230530.

c. Disconnect Switch - Factory wired and mounted.

d. Fan Speed Controller (For Direct Drive Models Only) - Factory wired and mounted.

4. Basis-of-Design: Cook ACE.

2.03 CEILING MOUNTED EXHAUST FANS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Panasonic, Broan.

B. Motor/Blower:

1. Totally enclosed DC brushless motor technology rated for continuous run.
2. Power Rating shall be 120 volts and 60 Hz.
3. Fan shall be UL listed for tub/shower enclosure when used with a GFCI branch circuit wiring and use in insulated ceiling (TYPE I.C.).
4. Motor equipped with thermal cut-off fuse control.
5. Removable with permanently lubricated plug–in motor.

C. Housing:

1. Rust proof paint, galvanized steel body.
2. Detachable 6" diameter duct adapter.
3. Built-in backdraft damper.
4. Expandable extension bracket up to 24".
5. Double hanger bar system allowing for ideal positioning.
6. With UL listed factory radiation damper where called for in the plans.

D. Grille:

1. Attractive design using PP material.
2. Attaches directly to housing with torsion springs.

E. Warranty:

1. The factory warranty shall be a minimum of 6 years limited warranty on the motor and 3-year limited warranty on parts. Ventilating fan shall be ceiling mount type, ENERGY STAR rated with variable speed of 0-80 CFM and no more than 0.3 sone as certified by the Home Ventilating Institute (HVI) at 0.1 static pressure in inches water gauge. Power consumption shall be no greater than 12.1 watts and ENERGY STAR rated. The motor shall be enclosed with brushless DC motor engineered to run continuously. Power rating shall be 120v/60Hz. Duct diameter shall be no less than 6”. Fan shall be UL and cUL listed for tub/shower enclosure when used with GFCI branch circuit wiring. Fan shall be UL listed for use in insulated ceiling (TYPE I.C.). Fan shall be California Title 24 compliant.

F. Performance:

1. Ventilating fan shall be ceiling mount type, ENERGY STAR rated with variable speed of 0-80 CFM or 0-100 CFM, and no more than 0.3 sone as

certified by the Home Ventilating Institute (HVI) at 0.1 static pressure in inches water gauge. Power consumption shall be no greater than 12.1 watts and ENERGY STAR rated. The motor shall be enclosed with brushless DC motor engineered to run continuously. Power rating shall be 120v/60Hz. Duct diameter shall be no less than 6". Fan shall be UL and cUL listed for tub/shower enclosure when used with GFCI branch circuit wiring. Fan shall be UL listed for use in insulated ceiling (TYPE I.C.). Fan shall be California Title 24 compliant.

2. For bathrooms:
   a. The bathroom fans shall run continuously.
   b. Provide fans with integral 20-minute delay-off timer to re-index the fan back to low speed.
   c. Provide a 2-pole wall switch, coordinate with division 26000. The wall switch shall turn ON the LED light AND index the fan to high speed. When the switch is OFF, the light shall turn OFF the fan shall index to low speed after 20 minutes.
   d. UL listed for wet location when protected by a GFCI circuit. Fan/light unit to be installed over tub/shower and centered as much as is allowable by the building structure.
3. For all other spaces:
   a. The fans shall run continuously.
   b. Fan airflow shall be set as scheduled on the contract documents.
   c. No LED light kit.

G. DC Motor Technology:
   1. Allows the fan to run continuously at a pre-set lower level as scheduled. The fan then elevates to a maximum level of operation when the switch is turned on.
   2. When fan faces static pressure, its speed is automatically increased to ensure that the desired CFM is not compromised, which allows the fan to perform as rated.

H. Basis of Design: As Per Schedule.

2.04 INLINE BLOWERS/INLINE FANS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:
   1. Acme, Cook, Greenheck, Hartzell, New York Blower, Twin City, PennBarry.

B. Square Centrifugal Blowers:
   1. Construction:

a. The fan shall be bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge galvanized steel with integral inlet and outlet flanges.

b. Pivoting motor plate shall utilize threaded L-studs for positive belt tensioning.

c. Bolted access doors shall be provided on three (3) sides, sealed with close cell neoprene gasketing.

d. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation.

2. Wheel:

a. Wheel shall be aluminum, non-overloading, centrifugal backward inclined, flat blade type. Hub shall be cast and precision machined, also constructed of 100% aluminum.

3. Accessories:

a. OSHA Belt Guard.

b. Motor Cover.

c. Disconnect Switch - Factory wired and mounted.

d. Motorized Damper

e. Speed Controller (For Direct Drive Models Only) - Factory wired and mounted.

4. Basis-of-Design: Cook SQN.

## 2.05 CEILING MOUNTED DE STRATIFICATION FAN

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Zoo Fans, Leading Edge, Macro-Air, Big Ass Fans.

B. Construction:

1. Enclosed air foil blades. Blades constructed of composite.

2. Totally enclosed motor. All motors shall be direct-drive permanent split capacitor type, with permanently sealed ball bearings. All motors to have built in, self-resetting (internal) thermal overload protector.

3. Remote variable speed control switch.

4. Fans shall be UL listed Standard 507 with matching UL listed solid state controls.

5. All fans to have factory installed secondary support cable assembly connected to the motor shaft, with galvanized cable 1/8 in. 7 x 7 with rated breaking strength of 920 lbs., and must comply with CSA Standard C22.2.

6. Swivel mounting base if used in a sloped ceiling application.

C. Accessories:

1. Totally enclosed impact resistant fan guard.

D. Basis-of-Design: Product indicated in schedule.

2.06 CONTROL (MOTORIZED) DAMPERS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Ruskin, Tamco, Greenheck.

B. Provide control dampers as shown on the drawings and diagrams, to meet the following minimum construction standards:

1. Leakage: Class 1, 4 CFM/sq. ft. at 1 in. w.c., tested per AMCA Standard 500-D-98, and AMCA Standard 500-D-98, and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage.
2. Frame: 16-gauge galvanized steel structural hat channel with tabbed corners for reinforcement to meet 13-gauge criteria.
3. Blades: 14 gauge (equivalent thickness galvanized steel) roll forward air foil type for low pressure drop and low noise generation. Blades shall be parallel for two-position dampers and opposed, for modulating dampers.
4. Blade Seals: Ruskiprene, suitable for -72°F to 275°F mechanically locked into the blade edge.
5. Jamb Seals: Flexible metal compression type.
6. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage concealed out of the airstream.
7. Bearings: Corrosion resistant, permanently lubricated stainless steel sleeve.
8. Dampers subject to corrosive fumes or humidity shall be constructed of stainless steel.
9. Dampers over 48 in. in length and height shall be made in multiple sections.
10. Where damper sizes are not specifically indicated, they shall be sized by the Building Management System Contractor. Maximum velocity shall be 1500 FPM and maximum pressure drop 0.1 in. w.g.
11. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package Ruskin Model SP-100.
12. Dampers shall be as manufactured by Ruskin CD 60 control damper, or equivalent Tamco, Greenheck or Nailor.
13. Basis of Design: Ruskin CD60.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF EQUIPMENT

A. Provide equipment in accordance with manufacturer's instructions. All fans shall meet the intent of the system performance requirements. Provide rubber in-shear vibration isolation for all fans unless otherwise called for. Provide necessary support steel for equipment. Provide guards for all exposed belts, shafts, and fan wheels. Change pulley sizes or adjust sheaves as required to make systems deliver specified quantities of air as listed on the Contract Drawings.

END OF SECTION

SECTION 23 35 16.11
OVERHEAD VEHICLE EXHAUST SYSTEM

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings.

1.02 SUBMITTALS

A. Submittals shall include shop drawings and product data for all specified equipment, materials and accessories.

## PART 2 - PRODUCTS

2.01 GENERAL

A. The vehicle exhaust system equipment and accessories shall be a standard product of a single manufacturer.

B. Warranty: Two (2) year parts and labor.

2.02 CENTRIFUGAL FAN

A. Refer to section 233400 - Fans for additional fan information.

B. The fan shall be specifically designed for the conveyance of diesel smoke and gases in accordance with Federal, State, and local code requirements as it applies to conveying explosive and carcinogenic particulate and gases produced by internal combustion engines. The fan housing and all components exposed to the combustible properties of the atmosphere within the ductwork created by the vehicle exhaust are explosive proof. The housing as well as the fan impeller shall have a construction of non-sparking, non-ferrous metal (cast aluminum).

C. Fan shall be horizontal discharge with motorized discharge damper. Fan shall be equipped with bottom drain.

D. Provide Teflon shaft seals to keep aluminum housing and fan drive shaft from making abrasive contact.

E. The fan motor shall be provided with a totally enclosed fan cooled motor. The motor shall be located outside of the air stream.

2.03 DUCT SYSTEM

A. All ductwork shall be 22 gauge galvanized spiral, with all hardware including screws shall be steel.

B. 14 in. diameter hose shall be provided for connection to the vehicle. The hose shall contain high visibility yellow strips, and be 2100°F rated continuous and be rated for 2370°F intermittent. Hose to have external metal helix with heat resistance outer fabric, middle insulation layer and inner layer of stainless steel mesh.

C. 8 in. diameter hose shall be provided for connection to the vehicle. The hose shall contain high visibility yellow strips, and be 1200°F rated continuous and be rated for 1380°F intermittent. Hose to have external metal helix with heat resistance outer fabric, middle insulation layer and inner layer of stainless steel mesh.

D. The exhaust system shall be designed to transport exhaust emissions in the main duct a minimum of 4,000 feet per minute ad provide a capture velocity no less than 5,800 feet per minute. The velocities shall be calculated at an average temperature of 250°F and static resistance of water gauge.

E. The duct system shall be substantially air-tight to comply with CLASS 2 Product-conveying duct codes established by BOCA - Building Officials Code Administrators, UMC - Uniform Mechanical Codes, ACGIH - American Conference of Governmental Industrial Hygienists, SMACNA - Sheet Metal Air Conditioning Contractors National Association.

2.04 MISCELLANEOUS VEHICLE EXHAUST SYSTEM MODIFICATIONS

A. Flexible hose assembly shall not be allowed to touch or rub the body of the vehicle at any time. No attachments to the body of the vehicle is permitted.

B. The boom to be a minimum of 20 ft. long one piece extruded aluminum with channel to accept ball bearing rollers of the traveling trolley on bottom side. Rubber impact end stops are to be mounted on each end of the boom. The traveling trolley shall be galvanized steel assembly with four upper ball bearing wheels to fit inside boom profile and two lower ball bearing wheels to fit on outside if track profile to prevent rocking or shifting of the trolley as it moves along the full length of the boom.

C. Provide blast gate at inlet of all hoses. Blast gate shall be full size of hose.

D. Provide all required equipment shown on drawings.

E. Provide stainless steel tapered inlet nozzle, lifting sleeve add-on for nozzle, and 10ft lifting pole.

2.05 DESIGN EQUIPMENT

A. Monoxivent Vehicle Exhaust Ventilation Apparatus.

2.06 MANUFACTURERS

A. Monoxivent, Car-Mon Products, Inc., Harvey Industries, Inc., and PlymoVent.

## PART 3 - EXECUTION

3.01 GENERAL

A. Install equipment in accordance with manufacturer's instructions. Provide necessary support steel for exposed work ductwork. Provide guards for all exposed belts, shafts and fan wheels. Change pulley sizes or adjust sheaves as required to make systems deliver specified quantities of air as listed on the Contract Drawings. Provide necessary power and control wiring from control unit to exhaust fan.

END OF SECTION

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SECTION 23 36 00
VARIABLE VOLUME TERMINAL UNITS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Drawings.

1.02 SUBMITTALS

A. Submit product data for terminal units including room number, maximum and minimum CFM, accessories, pressure drops, discharge and sound power data by octave band. Clearly indicate box sizes being proposed. Submit separately the controller and control interface devices being utilized.

## PART 2 - PRODUCTS

2.01 TERMINAL UNITS

A. General Unit Construction:

1. Unit shall be pressure independent and unit casing shall be constructed of 22 gauge welded galvanized steel. Each unit shall be internally lined with 1/2 in. minimum 1-1/2 lb./ft.$^3$ fiberglass insulation which meets NFPA 90A and UL 181. Factory label each unit with size, location, minimum and maximum CFM, and calibration chart. Air terminal units shall be capable of operating at 10 in. w.g., pressure maximum without damage. Maximum casing leakage at 3 in. W.G. shall be 2%.
2. Units to be certified under ARI Standard 880-94 Certification Program and carry ARI seal.
3. Units shall be provided of heating coil, with factory access door option.

B. Control and Volume Regulating Devices:

1. Internal unit damper shall be constructed of galvanized steel with blade-end seals for tight shut-off with a maximum damper leakage of 2% against a maximum of 3 in. w.g. Damper shall be mounted on a galvanized steel shaft extending through the unit on torque free bearings. Terminal shall have normally open dampers. Minimum and maximum air quantities shall be factory set, but may be field adjustable. Neither the radiated or discharge sound power levels shall exceed the ratings of design equipment as scheduled on the Contract Drawings.

C. Hydronic Reheat Coil:

1. Coil shall be factory installed on the terminal unit and shall be constructed of 1/2 in. copper tube with aluminum plate fins. Tested at the factory to 250 PSI hydrostatic pressure. Control valves shall be provided by the

temperature control subcontractor as described in Section 230923. Output capacity and rows as scheduled on the Contract Drawings.

D. Terminal Volume Controller (Microprocessor Based):

1. Provide unit with airflow velocity and total pressure sensor suitable for up to 3000 fpm inlet velocity. Sensor shall be averaging type with multiple sampling points on cross grids. Pressure independent microprocessor based electronic controller shall modulate airflow to maintain space temperature.

2. Provide a 24 volt electric damper actuator. The actuator shall be reversible with a switch and have a visual position indicator. The housing shall be NEMA type 2 with a flammability rating conforming to UL94. The actuator shall be maintenance free and have a minimum life span of 60,000 cycles. Actuator shall be Bellimo NMB24-3US. Johnson M 9109 - AGA2, Honeywell MNG110A1003.

3. Provide factory mounted transformers for controller and actuator suitable for 120 volt, 1 phase-input power.

4. Wall mounted thermistor type electric space sensor provided by Control subcontractor. Controller shall interface with Building Management System to provide analog outputs for space temperature and airflow and accept analog inputs position the actuator for warm-up or pull-down and change space temperature set-point for night set-back, set-up or occupancy sensor status. Controller shall sequence reheat coil to maintain space.

5. The VAV box manufacturer shall provide the box and the airflow sensor . The temperature control subcontractor shall field install the microprocessor based controller and damper motor.

E. Design Equipment: As Scheduled.

F. Acceptable Makes: Anemostat, Carrier, Carnes, Envirotech, Krueger, Titus, Tuttle and Bailey, Trane, Nailor.

## PART 3 - EXECUTION

### 3.01 GENERAL REQUIREMENTS

A. Suspended terminal units from the building structural system independent of the ceiling system. If this cannot be accomplished, provide additional intermediate angle iron from which the units shall be suspended. Level each unit. Access to the terminal unit controls shall be accomplished by remove of ceiling panels or through an access door. Coordinate locations of access doors.

END OF SECTION

SECTION 23 37 13

# REGISTERS AND DIFFUSERS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Registers/Grilles/Diffusers: Submit product data including room schedule listing size, CFM, throw, direction of throw, accessories, finish, material type, color chart, pressure drop and noise criteria.

1.03 GENERAL REQUIREMENTS

A. Each manufacturer shall check noise level ratings for registers and diffusers to insure that the sizes selected will not produce noise to exceed N.C. - 24, measured at occupant level; notify Owner's Representative of problems prior to submittal.

B. Pressure drop, airflow and noise criteria selection is based on design equipment. Manufacturers not submitting design makes must provide written certification in front of submittal that equipment submitted has been checked against and performs equal to the design make.

C. Borders and frames shall be coordinated with materials and ceiling systems to integrate with architectural ceiling details and finishes scheduled.

D. Locations of ceiling mounted air terminal devices shall be coordinated with locations shown on architectural reflected ceiling plans.

E. 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. 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.

1.04 REQUIREMENTS FOR REGISTERS

A. General:

1. A register is defined as a grille plus a volume damper.
2. Registers shall be installed "sight-proof" where possible, i.e.: High wall register with horizontal blades inclined up, or along a wall with blades facing the wall.
3. Borders and frames shall be of the same material as register face unless specified otherwise.

B. Mounting Frames:

1. Provide with screw holes in register face punched and countersunk at factory, and mounting frame drilled and tapped to suit. Sponge rubber gasket between frame and wall or ceiling for all surface mounted frames.
2. Frame shall be overlap type and shall be suitable for type of ceiling where register is to be installed.

C. Finishes:

1. Baked enamel (of colors as selected from the manufacturer's standard color chart) etched and lacquer, natural anodized, as scheduled.

D. Design Equipment: Titus unless otherwise noted.

E. Manufacturers: Anemostat, Carnes, Krueger, Titus, Price, Tuttle and Bailey, Nailor.

1.05 REQUIREMENTS FOR DIFFUSERS

A. General:

1. Provide four way blow unless otherwise noted.
2. Where manufacturer's size recommendations require duct sizes or connections differing from design, Contractor shall provide at no change in contract price.
3. Suitable for recessed mounting unless otherwise indicated.
4. Provide square to round neck transitions as required.
5. Provide sponge rubber gasket for all surface mounted frames.

B. Finishes:

1. Baked enamel (of colors as selected from the manufacturer's standard color chart) etched and lacquer, natural anodized, as scheduled.

C. Frame style shall be suitable for ceiling type in which diffuser is to be installed.

D. Design Equipment: Titus unless otherwise noted.

E. Manufacturers: Anemostat, Carnes, Krueger, Titus, Price, Tuttle and Bailey, Nailor.

## PART 2 - PRODUCTS

2.01 SUPPLY TYPES

A. Type 1 - (Smooth Face Type):

1. Steel construction with 22 gauge back pan and 22 gauge face panel with rolled edges that finishes flush with ceiling system.
2. Round neck - minimum 1-1/4 in. collar for duct connection.

3. Frame suitable for ceiling type.
4. With optional directional air flow pattern controllers that are concealed behind the face or in the neck.
5. Face panel shall be removed and securely held in place to the back pan without noise or vibration.
6. Horizontal airflow pattern.
7. Panel Size: 24 in. x 24 in.
8. Model: Titus OMNI.

B. Type 2 - (Spiral Duct Drum type):
1. Aluminum 20 gauge construction with adjustable horizontal and vertical vanes and rotating barrel for up to 60 deg. of directional control.
2. Diffuser shall be designed to fit tightly to spiral ductwork.
3. Opposed blade damper with front face operator.
4. Model: Titus S-DL-SV.

C. Type 3 - (Drum type):
1. Aluminum 20 gauge construction with adjustable horizontal and vertical vanes and rotating barrel for up to 60 deg. of directional control.
2. Diffuser shall be designed to fit tightly to rectangular ductwork.
3. Opposed blade damper with front face operator.
4. Model: Titus DL-SV.

2.02 RETURN/EXHAUST TYPES

A. Type A - (Exhaust and Return Grilles):
1. Steel construction with 22 gauge frame and blades, with horizontal bars on a 3/4 in. spacing set at 35° fixed deflection.
2. 1-1/4 in. wide flange.
3. The blades shall be parallel to long dimension.
4. Model: Titus 350-RL.

B. Type B - (Aluminum Exhaust and Return Grille):
1. Aluminum construction with horizontal blades on a 3/4 in. spacing and set at 35° fixed deflection.
2. 1-1/4 in. wide border with minimum thickness of .040 - .050 in. interlocked at all four corners and mechanically fastened.
3. The blades shall be parallel to long dimension.
4. Model: Titus 350-FL.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions. Rough in or install per reflected ceiling plan or in location instructed by Owner's Representative.

B. When the final connection to an exhaust or return grille is made, a 12 in. minimum height plenum box must be supplied to all grilles. Plenum dimensions shall match grille size. Paint inside of plenum box flat black.

C. Seal all supply and return registers, grilles and diffusers during construction operations to limit dust entering HVAC systems and ductwork. Seals may be removed just prior to testing and balancing, but not without the approval of the Owner's Representative.

END OF SECTION

SECTION 23 37 23.16
PENTHOUSES

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS TO THE ARCHITECT/ENGINEER

A. Penthouses including materials, finishes and accessories.

B. Provide original color charts for selection of finish.

## PART 2 - PRODUCTS

2.01 PENTHOUSES

A. Housings shall be minimum 18 gauge aluminum bolted to a minimum 8 gauge aluminum support structure.

B. The aluminum base shall be of bolted and welded construction.

C. Provide a curb as per Specification Section 230530.

D. Provide aluminum bird screen.

E. Design Equipment: Cook, TR.

F. Makes: PennBarry, Carnes, Greenheck, Arrow, Cook.

## PART 3 - EXECUTION

3.01 GENERAL

A. Install penthouses as per manufacturer's recommendations.

END OF SECTION

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SECTION 23 51 02
PREFABRICATED FLUE GAS VENTING SYSTEM

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. All work in this section shall comply with the General Mechanical Specifications.

B. This section includes specifications for furnishing and installing Non-Positive and Positive Pressure Vent systems for Condensing and Non-Condensing applications.

1.02 QUALITY ASSURANCE

A. Where applicable, products furnished under this section shall conform to the requirements of NFPA 54 and NFPA 211, and shall comply with UL 1738, Standard for Venting Systems for Category I, II, III, and IV Gas-Burning Appliances, and all other applicable standards.

B. All flue gas carrying components of the vent system shall be obtained from a single manufacturer.

C. The flue gas venting system materials must be furnished by the manufacturer of the boiler or water heater if the efficiency is greater than 85%, as per the requirements of NFPA 85 and 211.

D. The flue gas venting system shall have a warranty of ten (10) years (minimum).

1.03 SUBMITTALS

A. Submit a fully dimensioned, scaled shop drawing, showing plan and elevational views of the entire flue gas venting system. The detailed drawing shall indicate all section sizes and the specific fittings to be installed. The drawing shall include all supports (vertical and horizontal) applicable to the project. The drawing shall be prepared and approved by the system manufacturer.

B. Submit product data showing complete material and construction details for flue gas venting system and accessories.

C. Submit Drawings showing floor and roof openings, which shall indicate exact sizes and locations.

D. Provide documentation of a product warranty of ten (10) years or more.

## PART 2 - PRODUCTS

2.01 TYPE B GAS VENT

A. General:

1. Suitable to serve hot water boilers and hot water heaters utilizing natural gas.

2. Factory built all metal flue gas vent system with modular components. Suitable for outdoor installation and up to 450°F flue temperature.

3. Designed to handle negative or neutral internal pressures.

4. Double wall with minimum 1/2 in. air space between the walls.

5. Adjustable lengths with closely fitting sliding internal section with graphited mineral fiber packing gland and a sliding outer section to absorb thermal expansion.

6. B vent shall be used for all parts of the system. Single wall vent connectors are not acceptable.

B. Outer Jacket:

1. Galvanized steel.

C. Inner Gas Pipe:

1. Aluminized steel.

D. Accessories:

1. Rain cap.

2. Wall support assembly, wall guide assembly and plate support assembly.

3. Fittings to suit job conditions.

4. Drained tee cap, tee connection, inside V bands, ventilated roof thimble, external channel bands, and other necessary hardware as required for complete installation.

E. Design Equipment: Metal-Fab, Inc.

F. Manufacturers: Metalbestos, Metal-Fab, Hart and Cooley, Van-Packer, Schebler.

2.02 SPECIAL GAS VENT

A. Vent shall have a 1 in. space, and have an inner liner constructed of AL29-4C superferritic stainless steel with a minimum thickness that shall meet or exceed

the requirements of UL 1738. All products shall be factory-built special gas type, engineered and designed for use on Category I, II, III, and IV appliances.

B. Maximum positive pressure rating of 6 in. wc.

C. Maximum continuous flue gas temperature shall not exceed 550°F (288°C).

D. Vent shall be constructed with an inner conduit constructed of AL29-4C superferritic stainless steel with a minimum thickness that shall meet or exceed the requirements of UL 1738. The closure system shall be a Ring-and-Tab mechanical closure system that is integral to the system.

E. The outer wall casing shall be constructed of 430 stainless steel that shall not require additional surface preparation, such as painting, in order to withstand the outdoors or high humidity environments.

F. Inner conduit and outer wall casing shall be constructed in a fashion which prevents cross-alloy contamination and allows free movement between the two, allowing for varying rates of expansion and contraction to occur.

G. System is to be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and other applicable codes.

H. Contractor shall supply double wall AL29-4C product for all exhaust gas carrying runs. Combustion air intake shall be single wall galvanized ductor PVC with insulation as specified in Specification Section 230710.

I. Joints to be sealed with factory supplied sealant. Joints shall be designed to minimize collection of condensate in both horizontal and vertical runs. Joints shall not use screws or other lesser alloy fasteners that penetrate the inner conduit.

J. General Electric RTV106 High Temperature Silicone Sealant shall be used to seal all joints on systems where the maximum flue gas temperature will not exceed 550°F. Sealant shall be per manufactures installation instructions be maintain product listings.

K. RTV Sealant may be used to seal all joints on systems where the maximum flue gas temperature will not exceed 300°F. Sealant shall be per manufactures installation instructions be maintain product listings.

L. Design Equipment: Heat Fab.

M. Acceptable Manufacturers: Heat-Fab, Hart and Cooley, Ampco, Schebler.

## PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Provide flue gas venting systems of sizes as shown on Drawings. Sizes are clear inside dimensions. Maintain minimum clearances between vent system and existing construction.

B. Install in strict accordance with NFPA 54, NFPA 211 and manufacturers recommendations.

C. Provide adjustable lengths between two fixed points to permit thermal expansion.

D. Seal joints with sealant suitable for temperature in excess of specified intermittent flue temperature ratings.

E. Support as recommended by the manufacturer. Provide all necessary braces, guides, guy wires, tensioners and supports. Fasteners shall penetrate wall and terminate on inside of wall with steel bearing plates.

F. Provide threaded hose end ball valve with cap and chain, at base of drained tee fitting.

G. Individual flues that penetrate the roof shall terminate a minimum of 4 ft. apart, or as per the manufacturer's recommendations.

H. Horizontal runs of a flue gas venting system shall be installed at a slope of not less than 1/4 in. per foot, to allow for proper drainage of condensate back to the boiler or water heater condensate disposal system.

END OF SECTION

SECTION 23 52 16
CONDENSING BOILERS

## PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes packaged, factory fabricated and assembled, wall mountable, gas fired, water-jacketed, condensing boilers, trim, and accessories.

1.02 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Shall be submitted to the Engineer for approval and shall consist of:

1. General assembly drawing of the boiler including product description, model number, dimensions, clearances, weights, service sizes, etc.
2. Schematic flow diagram of gas valve trains.
3. Schematic wiring diagram of boiler control system. Schematic wiring diagram shall be ladder type showing all components, interlocks, etc. Schematic wiring diagram shall clearly identify factory wiring and field wiring.

C. Installation Instructions: Manufacturer's printed instructions for installation shall be submitted to the Engineer for approval.

D. Boiler Inspector's Certifications: As specified hereinafter, shall be submitted in writing prior to final acceptance by the Engineer.

E. Factory Test Reports: Factory test reports, as specified hereinafter, shall be submitted prior to final acceptance by the Engineer.

F. Field Test Reports: Field test reports, as specified hereinafter, shall be submitted prior to final acceptance by the Engineer.

G. Operation and Maintenance Manuals: Manufacturer's printed operation and maintenance manuals shall be submitted prior to final acceptance by the Engineer. Operation and maintenance manuals shall contain shop drawings, product data, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data, complete parts list, etc.

H. Manufacturer's Field Service: Manufacturer's printed field service procedures shall be submitted prior to final acceptance by the Engineer. Field service procedures shall include the name of boiler manufacturer's field service manager and phone number of boiler manufacturer's field service department.

1.03 WARRANTIES

A. Heat exchanger and fuel burner shall be warranted for a period of five (5) years from date of shipment.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.05 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. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements".

D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers".

E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment". Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

**PART 2 - PRODUCTS**

2.01 ACCEPTABLE MANUFACTURER'S

A. Basis of Design Product: Subject to compliance with these requirements, provide Harsco P.K. Mach Boilers or comparable product as manufactured by:

1. Lochinvar
2. DeDetrich
3. Triad Triumph
4. Equivalent.

2.02 GENERAL

A. Provide knight Series factory "packaged" low pressure hot water boilers as manufactured by Lochinvar or as approved and accepted by the Engineer. Each factory "packaged" boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring

and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.

B. Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

2.03 PERFORMANCE CRITERIA

A. The minimum boiler combustion efficiencies allowed, per the below chart:

| | **140°F Return Water** | **120°F Return Water** | **100°F Return Water** | **80°F Return Water** |
|---|---|---|---|---|
| 100% Input | 89.3% | 89.4% | 92.6% | 95.9% |
| 80% Input | 89.7% | 89.9% | 93.6% | 96.9% |
| 60% Input | 89.9% | 90.7% | 94.5% | 98.0% |
| 40% Input | 90.0% | 91.6% | 95.6% | 98.0% |
| 20% Input | 90.1% | 93.0% | 96.6% | 99.1% |

B. Low NOx burner shall be certified by SCAQMD. NOx levels not to exceed the following when O2 corrected to 3%: 20-50% firing rate - 9.9 PPM, 75-100% firing rate - 10.4 PPM.

C. CO to be no more than 4% at all firing rates.

D. Boiler noise ratings to be less than: 48 dBA @ 100% firing rate, 42 dBA @ 60% firing rate and 35 dBA @ <50% firing rate.

E. Boiler shall comply with ASME Section IV for 125 PSIG (max 250°F).

F. Fuel shall be natural gas with an assumed higher heating value of 1,000 Btu./cu. ft. and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5 in. wc to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14 in. wc.

2.04 BOILER DESIGN

A. The BOILER shall bear the ASME "H" stamp for 80 psi working pressure and shall be National Board listed. The BOILER shall have a fully welded, stainless

steel, fire tube heat exchanger. There shall be no banding material, bolts, gaskets or "O" rings in the pressure vessel construction. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. The condensate collection basin shall be constructed of welded stainless steel. The complete heat exchanger assembly shall carry a fifteen (15) year limited warranty

B. The heat exchanger shall have a volume of water no less than:

| Model | Water Content |
|---|---|
| KHB285 / WHB285 | 4.9 gallons |

C. The BOILER shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard. The BOILER shall operate at a minimum of 95% AFUE Efficiency (KHB/WHB055-285) and 94.4% THERMAL Efficiency (WHB399) as registered with AHRI. The BOILER shall be certified for indoor installation.

D. The BOILER shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided for observing the burner flame and combustion chamber. The burner shall be a premix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide smooth operation at all modulating firing rates. The BOILER shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The BOILER shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

E. The BOILER shall utilize a 24 VAC control circuit and components. The control system shall have a factory installed display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The BOILER shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 30 psi (standard); outlet water temperature sensor with a dual thermistor to verify accuracy; system supply water temperature sensor; outdoor air sensor, flue temperature sensor with dual thermistor to verify accuracy; low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.

F. The BOILER shall feature the “SMART SYSTEM™” control which is standard and factory installed with 128 x 128 resolution display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities,

USB drive for simple uploading of parameters and a PC port connection for connection to a local computer for programming and trending. A secondary operating control that is field mounted outside or inside the appliance is not acceptable. The BOILER shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The BOILER shall have a built-in "Cascade" with leader redundancy to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal "Cascade" function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The BOILER shall be capable of remote communication via optional CON-X-US™ Remote Connectivity with the capability of historical trending and sending text message or email alerts to notify the caretaker of a boiler alarm and remote programming of onboard boiler control. The control must have optional capability to communicate via Modbus protocol with a minimum of 46 readable points. The BOILER shall have an optional gateway device which will allow integration with LON or BacNet protocols.

G. The "SMART SYSTEM™" control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (pump shall be supplied by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The BOILER shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.

H. The BOILER shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 46 connection points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Low Water Cut Off, Louver Proving Switch, Tank Thermostat, Domestic Hot Water Building Recirculation Pump Contacts, Domestic Hot Water Building Recirculation Temperature Sensor Contacts, Remote Enable/Disable, System Supply Temperature Sensor, Outdoor Temperature Sensor, Tank Temperature Sensor, Modbus Building Management System Signal and Cascade Control Circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single phase on all models. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.

2.05 BOILER CONNECTIONS

A. Each boiler shall be provided with all necessary inlet and outlet connections as shown on the Drawings.

## 2.06 BOILER TRIM

A. Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:

1. Safety relief valve shall be provided in compliance with the ASME code. Contractor to pipe to glycol feed tank.
2. Water pressure temperature gauge, minimum 3-1/2 in. diameter, normal operating range approx. 50% of full range.
3. Primary low water flow fuel cutoff (probe type with manual reset).
4. Manual reset high limit water temperature controller.
5. Operating temperature control to control the sequential operation of the burner.
6. Separate inlet and outlet water temperature sensors capable of monitoring flow.
7. Exhaust temperature sensor.
8. Drain valve, minimum 3/4 in. hose end ball valve.
9. Condensate neutralization kit with refillable media.

## 2.07 BOILER FUEL BURNING SYSTEM

A. The boiler manufacturer shall provide each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train and ignition system. The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

B. Each burner shall be provided with an integral gas firing combustion head.

C. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

D. Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall operate without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the LED display.

E. Each burner shall be of the radial-fired (down-fired) type and constructed of steel with a stainless steel inner and stainless steel mesh outer screen.

F. Each boiler shall be provided with a "Full Modulating" firing control system whereby the firing rate is infinitely proportional at any firing rate between 10% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.

G. Each boiler shall include a master/member microprocessor boiler controller to control each boiler's temperature, lead/lag sequencing of up to 24 hot water boilers in any combination of condensing and non-condensing boilers and flame safeguard functions. Each boiler to be supplied with LCD display/interface (4.75 in. x 6.25 in.) and tactile membrane keypad. Displayed at each boiler shall be complete boiler status, alarm and alarm histories with full text description of each.

H. The boiler controller shall have the following capabilities:

1. Maintain single set point for each boiler or supply temperature multiple boiler applications.
2. Reset the set point based on outdoor air temperature.
3. Sequence condensing/non-condensing hybrid boiler plants to optimize boiler efficiency and protect non-condensing boilers from condensing.
4. Boiler start rotation.
5. Boiler performance tracking.
6. Boiler/heating plant shutdown based on outdoor air temperature.
7. Internal dual set point program with an external switchover (e.g.: night setback with external clock, supplied by others).
8. Alarm relay for any for any manual reset alarm function.
9. Programmable low fire delay to prevent short cycling based on a time and temperature factor for release to modulation.
10. Frost protection.
11. Pump exercising.
12. Flue gas temperature/blocked flue protection.
13. Short cycle protection.
14. Local manual operation.
15. Remote Control Building Management Interface. The boilers shall be capable for interface with external control systems. This interface shall be via (RS-485 MODBUS RTU, LonWorks, BACnet, or MetasysN2) protocol two-way communication to, control boiler on/off and firing rate and read boiler status and error messages. The boiler controls shall also be capable of accepting a 0 - 10 VDC remote external analog signal to control the firing rate.
16. Computer (PC) interface for programming and monitoring all functions.

## 2.08 MAIN GAS VALVE TRAIN

A. Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:

1. One (1) manual shutoff valve.
2. Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.
3. Air - Gas ratio control (maximum inlet pressure 14 in. wc).
4. One (1) low gas pressure switch (manual reset).
5. One (1) high gas pressure switch (manual reset).
6. Two (2) pressure test ports.

## 2.09 IGNITION SYSTEM

A. Each boiler shall be equipped for direct spark ignition.

## 2.10 COMBUSTION AIR CONTROL SYSTEM

A. Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

1. The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.
2. One (1) low airflow differential pressure switch to insure that combustion air is supplied.
3. Intake air damper and filter.
4. High exhaust back pressure switch.

## 2.11 BURNER CONTROL SYSTEM

A. The ENVI boiler control system shall be supplied with a 24 VAC transformer (120 VAC, single phase, 60 Hz primary). The 120/1/60 power supply to each boiler shall be protected by a circuit breaker. Refer to electrical drawings for information.

B. The boiler shall include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.

C. Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.

D. Each boiler control system shall provide timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

2.12 BOILER CONTROL PANEL

A. General:

1. Provide a complete control system to control the boilers and auxiliaries. Provide a supply and return header temperature and boiler sequencing controller to cascade boilers into service and properly modulate their firing rates in unison to maintain the desired hot water supply temperature in the header.

2. Each boiler shall be given a specific address identification parameter for that particular model boiler unit. This feature is utilized in a "True" Hybrid system design to provide protection of the return water temperature differentiation between condensing and non-condensing boilers.

a. Individual temperature controlled modulation capability for each boiler as a standalone operation backup to the Master/Member Network system.

b. Each boiler shall be provided with a local/remote manual operation that transfers both firing rate control and operating limits.

c. Controller shall provide hot water supply temperature based on PID Control, header temperature setpoint, outside temperature reset, temperature setback and high and low hot water temperature limits.

3. Boilers shall have the ability to be started or stopped and modulate by a single 0 - 10V signal from any external control signal.

4. Arrange system components and wiring so that failure of a control and/or individual device, or field wiring short, for one boiler does not affect automatic and manual operation of other boilers.

5. All equipment shall be provided with necessary communication capabilities and hardware to allow integration with Mod-Bus Communications with Building Automation System.

6. A single component failure shall not affect the continued operation of the boiler to ensure continued operation in the event of a controller memory corruption or CPU failure.

B. Cascade Controller:

1. Enclosure:

a. Each boiler shall have a factory-assembled module that is cabinet mounted with all operator displays, indicators, control switches, power supplies, communications components and field terminals required for complete plant operations.

b. All operator interface control switches, indicators and displays shall be password protected.

c. Field wiring shall consist of one (1) twisted pair from boiler to boiler in a "daisy chain" fashion to provide for all communications and operations.

d. Provide a twisted pair wire to each header sensor transmitters and controller outputs for pumps, isolations valves or dampers.

e. Each controller shall be field configurable via an integral front panel keypad. Configuration and calibration data shall be stored in a non-volatile EEPROM memory with a minimum of ten (10) year data retention if (powered down).

f. Controllers shall be of US manufacture, microprocessor-based design to assure system integrity.

g. The controller shall be capable of providing an isolated Modbus RS-485 interface to allow connection to a facility's Building Automation System. Any additional protocol will be provided by factory engineering and supporting hardware. This interface shall be via (RS-485 MODBUS RTU, LonWorks, BACnet, or MetasysN2,) protocol two-way communication to, control boiler on/off and firing rate and read boiler status and error messages.

h. Controllers shall be approved by Underwriters Laboratories or a Nationally Recognized Test Lab (NRTL) to meet UL 508 and CSA C22.2 No. 14-95 requirements.

2. Displays:

a. The controller shall have a minimum 4.75 in. high by 6.25 in. wide LCD graphic display for boiler sequence operator control, alarm listing, fault historical trending and boiler control setup functions.

b. The controller's display shall be controlled by a tactile feedback membrane keyboard. The keyboard shall include both dedicated keys and alpha numeric keys for boiler parameter entry.

3. Control Relay Switches, Alarms and Indicators:

a. Alarm and status shall be displayed in real English (no codes) with date time stamped for six (6) most resent errors stored in error menu.

b. All control switches and indications shall be clearly identified using black lettering on a permanent white background.

c. The master/member operating control and alarm/status indications shall be provided for each boiler. In one location the operator shall have a complete status and controllability of the entire boiler system.

4. Cascade Sequencer:
    a. Sequence up to 24 boilers Master/Member Network. Sequence boilers regardless of size, input/output characteristics, return water temperature (minimums), condensing or non-condensing hybrid and/or manufactures model.
    b. Parallel boiler modulation, PID controlled modulation, hydronic or domestic.
    c. Boilers controlled to maintain a supply or return water header temperature.
    d. Appliance selection, each appliance shall be assigned an identity address with a particular firing rate (input) to start next unit in sequence to optimize total system efficiency. Specific parameters for that particular model boiler operating characteristics will be pre-programmed.
    e. Configure "True" Hybrid systems using a single control, non-condensing boilers do not run if return temperature is too low. Condensing boilers are limited to (adjustable) low fire if return temperature is too high to prevent short cycling.
5. Faults:
    a. Errors displayed in text format making it easier and quicker to diagnose problems "No Error Codes" display faults and program in real English language descriptions, time and date stamped.
    b. Six (6) most recent errors are stored in the Error Menu.
    c. Easier and quicker troubleshooting, I/O switches/relays are individually annunciated.
    d. Optional software for advanced set-up and diagnostics.
    e. Software flexibility paired with hardware durability.
    f. Open Predictive PID Proportional, integral, derivative shall work as one or independent to each boiler to accurately control firing rate to the temperature of a variable load to pin-point accuracy.

## 2.13 SOURCE QUALITY CONTROL

A. Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME "H" stamp.

B. Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

## PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall be responsible for unloading and rigging of the equipment. The Contractor shall be responsible for protecting the equipment from the weather, humidity and temperature conditions, dirt, dust, other contaminants, as well as jobsite conditions during construction.

B. Equipment shall be unloaded, handled, and stored in accordance with the manufacturer's handling and storage instructions.

3.02 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. The installation shall be provided by the Contractor in accordance with the requirements of the codes specified hereinbefore. All of the Contractor's work shall be performed in a workmanlike manner, by experienced workmen previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.

B. Install equipment in strict compliance with manufacturer's installation instructions.

C. Install equipment in strict compliance with state and local codes and applicable NFPA standards.

D. Maintain manufacturer's recommended clearances around sides and over top of equipment.

E. Install components that were removed from equipment for shipping purposes.

F. Install components that were furnished loose with equipment for field installation.

G. Provide all electrical control and power interconnect wiring.

H. Provide all fuel gas vent and service piping.

I. Provide all piping for boiler pipe connections.

J. Install condensate neutralization kit per manufactures installation instructions. Pipe to floor drain.

K. Contractor must, when filling the system with treated water, verify that the pH level is maintained between 6.0 and 8.5.

L. Contractor must verify that glycol and other additives must be approved by the glycol manufacturer for use in aluminum boilers and verify that the pH level is maintained between 6.0 and 8.5.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

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. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature, steam pressure.
   b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to Project during other than normal occupancy hours for this purpose.

E. Performance Tests:

1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
3. Perform field performance tests to determine capacity and efficiency of boilers.
    a. Test for full capacity.
    b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
4. Repeat tests until results comply with requirements indicated.
5. Provide analysis equipment required to determine performance.
6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
7. Notify Architect in advance of test dates.
8. Document test results in a report and submit to Architect.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Section 017900, "Demonstration and Training".

END OF SECTION

SECTION 23 62 13
AIR-COOLED CONDENSING UNITS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in the Contract Documents.

1.02 SUBMITTALS

A. Air-cooled condensing unit, complete with accessories.

B. Complete wiring and piping diagrams showing all piping and control interconnection.

C. Installation Manuals.

1.03 GENERAL REQUIREMENTS

A. Equipment Manufacturer shall be responsible for the following:

1. Furnish complete installation Drawings, templates, wiring diagrams and instruction manuals for the equipment.
2. Provide additional copies of above data for O&M Manual.
3. Provide refrigerant piping diagram prior to installation showing exact location and arrangement of piping and all devices required: Sight glass, solenoid valves, thermal expansion valves, filter dryers, shut off valves, charging valves, etc.
4. Supervise and check installation for compliance with manufacturer's recommendations.
5. Furnish spring vibration mounting equipment to prevent transmission of machine vibration to the building structure.
6. Complete start-up for each unit shall be performed under the direction of the manufacturers authorized representative.

B. Contractor shall:

1. Provide piping, valves and accessories to connect the condensing units to their respective units, including miscellaneous devices to make a complete and operable refrigeration system.
2. Provide one (1) year, 24-hour service and guarantee from date of final acceptance.

C. Electrical Wiring:

1. Division 26 will provide power wiring to condensing unit.

2. Division 23 will provide control wiring interlocks at units and interlocks to air handling units as required.

D. Start-Up, Testing and Instructions:

1. Provide complete installation, testing, wiring, start-up, and instructions to Owner's Representative.

## PART 2 - PRODUCTS

### 2.01 AIR-COOLED CONDENSING UNITS

A. GENERAL DESCRIPTION

1. Furnish as shown on plans, Condensing Unit(s) Unit performance and electrical characteristics shall be per the job schedule.
2. Configuration: Fabricate as detailed on prints and drawings.
3. The complete unit shall be ETL listed.
4. Units constructed in accordance with ANSI B9.1 and NEC.
5. Unit performance shall be certified in accordance with ARI Standard 460, latest edition.
6. Unit shall be completely factory assembled and shipped in one piece.
7. Unit to be shipped with a nitrogen holding charge only.
8. The unit shall undergo an operational test prior to shipment. The factory test shall include a refrigeration circuit check test, a unit safety control system operations checkout, and a final unit inspection.
9. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
10. Performance: All scheduled capacities and face areas are the minimum accepted value. All scheduled amps, KW, and HP are maximum accepted values that allow scheduled capacity to be met.

B. CABINET

1. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished surface to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

2. The unit base frame shall be constructed of 13 gauge pre-painted galvanized steel.
3. Lifting brackets shall be provided on the unit base with lifting holes to accept cable or chain hooks.

C. ELECTRICAL

1. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with unit shall be number and color coded and labeled according to the electrical diagram provided for easy identification.
2. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch circuit short circuit protection, 115 volt control circuit transformer and fuse, system switches, and a high temperature sensor. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Knockouts shall be provided in the side of the main control panels for field wiring entrance.
3. All 115-600 volt internal and external wiring between control boxes and components shall be protected from damage by raceways or liquid tight conduit.
4. The receptacle shall be powered by a field supplied 115V source.
5. Single non-fused disconnect swtich shall be provided for connecting electrical power at the unit. Disconnect switches shall be mounted internal to the control panel and operated by an externally mounted handle. Externally mounted handle is designed to prohibit opening of the control panel door without the use of a service tool.
6. Unit SCCR rating to be 10 kAIC.
7. Phase failure and under voltage protection shall be provided to prevent damage from single phasing, phase reversal, and low voltage conditions.
8. Unit shall be provided with a 24 volt transformer and terminal strip for field supplied controls.

D. CONDENSING SECTION

1. Air Cooled Condenser
   a. The condensing section shall be open on the sides and bottom to provide access and to allow airflow through the coils. Condenser

coils shall be multi-row and fabricated from cast aluminum micro-channel coils. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils are to be recessed so that the cabinet provides built in hail protection.

b. The fan casing or discharge attenuation shroud shall be made of heavy gauge steel with spun flanges and welded seams. Condenser fans shall consist of high pressure die cast aluminum airfoil blades, hub and clamp plate. The finish of the fan assembly shall consist of high pressure cleaning, application of one coat of primer and one coat of enamel paint. The fan RPM shall not exceed to allow 850 for quieter operation. All motors are totally enclosed air over design with a 1.15 service factor, Class F insulation with Class B rise, and 100,000 hour L10 bearings.

c. Units shall have at least one head pressure sensing condenser fan controlled to maintain positive head pressure. An ambient thermostat shall prevent the refrigeration system from operating below 45º F ambient. Condenser fan speed control shall be added to the last fan off on each refrigeration circuit to provide cooling operation to ambient temperatures down to 0° F. Fan speed control shall be field adjustable.

2. Scroll Compressors

a. Each unit shall have multiple, heavy-duty Copeland scroll compressors.

b. Each compressor shall be complete with gauge ports, crankcase heater, sight-glass, anti-slug protection, motor overload protection and a 5 minute time anti-cycling time delay.

c. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.

d. Safeties including low oil pressure and thermal cutoffs on each compressor.

3. Refrigeration Circuit

a. Each unit shall have two independent refrigeration circuits. Each circuit shall be complete with low pressure control, liquid line charging valve with a 3/8" charging port, a manual reset high pressure safety switch. Each Circuit shall be dehydrated, leak tested, and shipped with a Nitrogen holding charge.

b. Each compressor shall be complete with gauge, ports, crankcase heater, sight - glass, anti-slug protection, motor overload protection and a 5 minute time anti-cycling time delay.

4. Hot gas bypass capped T shall be factory installed on the discharge line of refrigerant circuits.

E. CONTROLS

1. Refrigeration capacity control shall be accomplished by staging of the unit's multiple compressors. Unit shall be equipped with a 120V terminal strip for field supplied and installed controls

2. Controls cabinet shall be separate from power cabinet and shall have gasketed door.

F. Casings:

1. Zinc-coated steel, phosphatized casings coated with epoxy resin primer and finished with baked enamel.
2. With full face louvers to protect coils from hail damage.
3. Equipped with unit mounting rails and drain holes.
4. Spring isolators between unit and roof supports.

G. Design Equipment: Daikin

H. Make: Carrier, Daikin Applied, Trane, York.

2.02 REFRIGERATION ACCESSORIES

A. Filter Dryers:

1. Liquid lines dryer ahead of solenoid valves in each system.
2. Replaceable cartridge type.
3. Make: Ansul, McIntire, Mueller, Sporlan.

B. Sight Glass:

1. In each liquid line close to evaporator, after filter dryer.
2. Make: Ansul Super Dry-Ey, Henry; with elements to act as moisture indicator; Sporlan.

C. Thermal Expansion Valve:

1. In each liquid line at evaporator coil.
2. Make: Sporlan, Henry, Parker.

D. Shut-Off Valves:

1. To isolate equipment components, packless type.

2. Make: Henry, Mueller, Superior.

E. Charging Valve:

1. Locate and install at a point to facilitate charging of the system.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Connect services to the unit where called for in complete accordance with the manufacturer's installation instructions. Furnish Division 26 with wiring diagrams and electrical data to permit power wiring connections to the unit. Provide control wiring serving air handling unit associated condensing unit, and the auxiliary control panel in accordance with Section "Electric Wiring". Charge system with refrigerant and proper quality of oil, after evacuating and leak testing, and in accordance with manufacturer's installation instructions. Provide roof equipment support rails.

END OF SECTION

SECTION 23 73 13
AIR HANDLING UNITS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Documents.

1.02 SUBMITTALS

A. Submit unit performance including capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations. Indicate unit shipping split locations, and split dimensions, installation and operating weights including dimensions.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit data on electrical requirements. Include safety and start-up instructions.

F. Submit sound data certified to ARI 260.

1.03 DELIVERY STORAGE AND HANDLING

A. Units may be shipped fully assembled or disassembled to the minimum module size in accordance with shipping or jobsite requirements.

B. The units must be rigged and lifted in strict accordance with the manufacturer's recommendations.

C. All unit openings must be sealed to prevent the entrance of construction dust.

D. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated (if applicable), condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test run under observation.

## PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The units shall consist of the AHU modules as shown on the plans.

B. Air handling units to fit intended use and location as called for. Capacity, size and arrangement, static pressure, brake horsepower, component parts and accessories as called for and as necessary to obtain required results and allow for proper maintenance. Ratings based on standard Test Code for Centrifugal Fans, adopted jointly by AMCA and ASHRAE. Each size fan to be supplied shall be tested in the manufacturer's laboratory under simulated installation conditions. Ratings based on test, not on interpolated or extrapolated calculation. Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. Guaranteed sound power level ratings not exceeding those of design equipment or as scheduled.

C. Source Limitations: Obtain modular indoor air-handling units through one source from a single manufacturer.

D. ARI Certification: Air-handling units and their components shall be factory tested according to the applicable ARI Standard and shall be listed and labeled by ARI.

E. More than one manufacturer is listed as make, Contractor must be certain that equipment submitted fits properly into indicated space conditions, same as design equipment.

F. Motors shall conform to the requirements of Specification Section 230513, "Motors".

G. Drives:

1. All motors and drives shall be factory-installed and run tested. All fans shall be direct drives.

2.02 AIR HANDLING UNITS

A. Unit Base:

1. Indoor Units: Provide factory-installed external support kit on the base of the unit. External support kit shall be used for ceiling suspension, external isolation, or with housekeeping pad. The external support kit for a floor mounted unit shall be 6 in. (minimum) height factory base rail. Unit mounting devices not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel.

B. Casing:

1. Indoor Units:

a. Unit shall be constructed of a complete structural frame with removable panels. Unit manufacturer shall ship separate segments so unit can be broken down for ease of installation in tight spaces. The entire air handler shall be constructed of 18 gauge G90 galvanized steel. Casing finished to meet ASTMB 117 250-hour salt-spray test. The removal of side panels shall not affect the

structural integrity of the unit. All removable panels shall be gasketed to minimize air leakage. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

b. Panels shall be 2" thick.

c. Indoor Units: Construct casing sections capable of operating from -6 in. w.g. to +5 in. w.g.

d. Casing leakage shall not exceed 0.5 cfm per square foot of casing at -6 in w.g. to 5 in w.g.

e. Access panels and/or access doors shall be available on both sides of the unit in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance. If panels are not removable, then manufacturer shall provide access sections with doors between all internal components to ensure access and cleanability of the air handler.

f. Access doors shall be double wall construction to prevent damage to insulation during routine maintenance.

g. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of all interior surfaces.

h. Door hardware shall be surface mounted to minimize penetrations in the door casing that could lead to air leakage paths.

i. All joints between exterior panels and structural frames, as well as joints between module frames, shall be properly sealed and gasketed to provide an air seal.

j. Insulation shall be encased in double-wall casing between exterior and interior solid panel such that no insulation can erode to the airstream. Foil facing on insulation is not an acceptable alternate to double wall construction. Insulation shall have a minimum R-Value of 13 and shall be UL listed. The installation shall comply with NFPA 90A and B requirements.

C. Fan Section(s):

1. Provide supply, return, exhaust fan section(s) as shown on the plans.

2. Provide self-aligning, grease lubricated pillow-block ball bearings selected for L-50 400,000 - for plug fans hour average life per ANSI/AFBMA 9. Extend both grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to drive-side bearing support.

3. Vibration levels shall be factory tested for VAV applications. Special balancing and structural components shall be provided to minimize harmonic vibrations.

4. Provide supply, return, exhaust fan sections with AF single width, single inlet centrifugal plug fans designed and suitable for class of service indicated on unit schedule. Fan shaft to be properly sized and protectively coated width lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Key fan wheels to fan shaft to prevent slipping. Provide galvanized expanded metal access door guards to prevent unauthorized entry into fan sections when access doors are opened. Design access door guards for removal from outside of unit. On plug fan sections with vertical down discharge, a safety grate shall cover the entire discharge opening to prevent service personnel from falling into supply air ductwork.
5. Fans shall be tested and rated according to AMCA210.
6. Mount fans on isolation bases. Internally mount motors on same isolation bases and internally isolate fans and motors with 1 in. spring isolators. Install flexible canvas ducts between fan and casings to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.
7. Fan sections shall have full height, double wall, hinged doors on one side for inspection and maintenance of internal components.
8. For fan sections controlled by variable frequency drives, balance at speeds between 25% and 100% of design RPM.
9. Belts shall be enclosed as required by OSHA standard 29 CFR 1910 to protect worker from accidental contact with the belts and sheaves.

D. Filter Section:

1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have filter guides and access doors extending the full height of the casing to facilitate filter removal. Provide filter block-offs as required to prevent air bypass around filters. Filters shall be removable from one side of filter sections.
2. Filter type, efficiency, and arrangement shall be provided as defined in project plans and schedule. Filters shall be removable from one side of filter section(s).
3. Provide 2 in. angled pre-filter sections with Merv 8 pleated filters.
4. Provide high efficiency final filter sections with 12 in. cartridge filters and 2 in. pleated pre-filters in order to provide proper filtration. High efficiency filters shall be Merv 13 and rated in accordance with ASHRAE 52 and UL Class 1.
5. Manufacturer shall provide one set of startup filters and an additional set of operational filters.
6. Provide magnehelic gauge across the filter banks.

E. Coils:

1. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
2. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
3. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
4. All coils shall be completely cleaned prior to installation into the air-handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
5. On stacked cooling coils, intermediate drain pans shall be installed between the coils. Intermediate drain pans shall have drop tubes to guide condensate to the main drain pan, thus preventing flooding of lower coils that would result in moisture carryover.
6. Hydronic Coils:
   a. Supply and return header connections shall be clearly labeled on outside of units such that direction of coil water-flow is counter to direction of unit airflow.
   b. All coils shall be tested and rated in accordance with ARI 401.
   c. Coils shall be drainable.
   d. Fins shall be aluminum with minimum 0.01 inch thickness.
   e. Tubes shall seamless copper and 5/8" tube diameter and 0.25" tube wall thickness.
   f. Coils shall be proof tested to 450 psig and leak tested to 300 psig air pressure under water.
   g. Headers shall be constructed of round copper pipe or cast iron.
   h. Penetrations shall be sealed with gasket and sealed.
7. Refrigerant Cooling Coils:
   a. Refrigerant suction and liquid connections shall be clearly labeled on outside of units.

b. Coils shall be proof tested to 450 psig and leak tested to 300 psig air pressure under water. After testing, insides of tubes shall be air dried, charged with dry nitrogen, and sealed to prevent contamination.

c. Refrigerant suction and liquid headers shall be constructed of copper tubing. Suction and liquid connections shall penetrate unit casings to allow for sweat connections to refrigerant lines and shall be gasketed.

d. Tubes shall be copper. Fins shall be aluminum.

e. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

f. Coils shall be tested and rated in accordance with ARI 410.

g. Fins shall be aluminum with minimum 0.01 inch thickness.

h. Tubes shall be seamless copper and 1/2" tube diameter and 0.25" tube wall thickness.

i. Penetrations of casing for coil connections shall be tightly gasketed and sealed to prevent air leakage.

F. IAQ Drain Pans:

1. Insulation shall be encased between 18 gauge G90 galvanized exterior and interior walls. Units with cooling coils shall have drain pans under complete cooling coil section that extend beyond the air-leaving side of the coil to ensure capture of all condensate in section. Cooling coil drain pans shall be sloped in 2 planes, pitched toward drain connections to ensure complete condensate drainage when unit is installed level and trapped per manufacturer's requirements. Drain pans shall have one drain connection on same side as floor drain.

2. All drain pan connections supplied by unit manufacturer including, piping, and piping connections extending from stainless steel drain pans shall be constructed of stainless steel. The contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

G. Dampers

1. All dampers shall be internally mounted. Dampers shall be premium ultra low leak and located as scheduled. Dampers shall be double-skin airfoil design for minimal air leakage and pressure drop. Leakage rate shall not exceed 5 CFM/square foot at one-inch water gauge and 9 CFM/square foot at 4 in. water gauge. All leakage testing and pressure ratings shall be based on AMCA Publication 500. Manufacturer shall submit brand and model of damper(s) being furnished.

2. Provide dampers to modulate the volume of outside air, return air, and exhaust air as shown. Configure the dampers as shown on the plans:

a. OA/RA Mixing Module.

b. Return fan economizer.

3. Provide a factory-mounted ASHRAE Standard 62 airflow monitoring and control station in the outdoor air opening of the mixing box. The monitor shall track a variable outside air quantity for ventilation demand flow control and ventilation flow documentation. The airflow monitoring station shall be factory-mounted, factory-calibrated, and installed per the airflow monitor manufacturer's recommendations. The air-handling unit mixing box shall also include a modulating outside air damper mounted in series with the airflow monitor. All linkages, crank arms, jackshafts and mounting hardware shall be provided. The airflow monitoring station shall be calibrated to measure a variable airflow from 15% of nominal air handler cfm up to 100% of design airflow, maintaining an accuracy of plus or minus five (5%) percent of actual cfm, for air measuring between -40F up to +158F. Monitoring station shall compensate for outside air temperature fluctuations that affect mass flow rate of air. The airflow monitoring station shall provide a proportional output velocity signal (2-10 vdc). The velocity sensor shall have an automatic zeroing function and shall be programmed to recalibrate the device's transducer a minimum of once per day to ensure continuous accuracy of airflow measurements. The monitor manufacturer shall provide to the Building Automation System (BAS) contractor a certified conversion table for the signal provided.

H. Miscellaneous Sections:

1. Turning and Discharge Plenum Modules: Shall be provided as shown to efficiently turn air and provide sound attenuation.

I. Design Equipment:

1. Indoor Style Units: Daikin.

2. Makes: Daikin Applied, Trane, York by Johnson Controls, Carrier.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide equipment in accordance with manufacturer's recommendations and compatible with intent of the respective system performance requirements.

B. Provide vibration isolators in accordance with manufacturer's recommendations, and as called for. Provide necessary steel supporting framework for equipment requiring same. Braced against swaying.

C. Provide 6 in. high concrete pads for all floor mounted air-handling units.

D. Install piping adjacent to machine to allow service and maintenance. Do not block access doors or coil pull-space with piping.

E. Pan Drains:

1. Connect condensate drain pans with full-size piping.

2. Construct trap with offset dimension and seal depth per manufacturer's recommendations. Install cleanouts at changes in direction.

3. Indoor Units: Extend to nearest equipment or floor drain.

F. Start-Test-Check:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

2. Engage a factory-authorized service representative to perform startup service.

3. Verify that shipping, blocking, and bracing are removed.

4. Verify that unit is secure on mountings and supporting devices and that connection to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

5. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.

6. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.

7. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

8. Verify that specified filters are installed. Check for leakage around filters.

9. Verify that cooling coil drain pans have a positive slope to drain.

10. Verify that the cooling coil condensate drain trap maintains an air seal.

11. Clean air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

12. After completing system installation and testing, adjusting, and balancing modular indoor air handling and air-distribution systems, clean filter housings and install new filters.

END OF SECTION

SECTION 23 81 26.11
DUCTLESS SPLIT SYSTEM AIR CONDITIONER

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Submit product data for split system ductless air conditioner, including condensing unit, refrigerant piping diagrams, O & M manual, and control and wiring schematics.

1.03 GENERAL REQUIREMENTS

A. Provide units to fit intended use and location as indicated:

1. Capacity, size and arrangement, component parts and accessories as scheduled and/or as necessary to obtain required results and allow for proper maintenance.
2. Unit capacities to be ARI 210 rated.
3. Unit to meet or exceed minimum SEER Requirements of New York State Energy Code and Department of Energy (DOE).

## PART 2 - PRODUCTS

2.01 AIR HANDLING UNIT(WALL MOUNTED TYPE)

A. Units shall be completely factory assembled including coil, condensate drain pan, fan, motor, filters and controls in an insulated casing. Units shall be UL listed and C.S.A. certified. Forward curved, dynamically and statically balanced fan with 3 speed direct drive. Fan motor bearing shall be permanently lubricated.

B. Units shall have sheet metal and steel frame construction and shall be painted with an enamel finish. Casing shall be insulated and knockouts shall be provided for electrical power and control wiring.

C. Unit shall have a single refrigerant circuit controlled by a flow control check valve (FCCV). Aluminum fin surface shall be mechanically bonded to 3/8 in. OD copper tubing. Coils shall be factory pressure and leak tested.

2.02 CONDENSING UNIT

A. The condensing unit shall be fully charged from the factory for up to 100 ft. of piping. The unit must be designed to operate at outdoor ambient temperatures as high as 115°F and as low as -20°F, with low-ambient kit. The unit shall be UL

listed. Unit casing shall be constructed of heavy gauge, galvanized steel and painted with a weather-resistant powder paint finish.

B. Refrigeration system controls include condenser fan and compressor contactor. High and low pressure controls shall be inherent to the compressor. A factory installed liquid line dryer shall be standard. The compressor shall feature internal over temperature and pressure protection, total epoxy dipped hermetic motor windings, thermostatically controlled sump heater, centrifugal oil pump, and internal spring mounts to reduce vibration and noise. The coil shall be continuously wrapped, corrosion resistant all aluminum glued with minimized brazed joints. The coil shall be 3/8 in. O.D. seamless aluminum glued to a continuous aluminum fin. The coil shall be protected on all four sides by louvered panels.

2.03 ACCESSORIES

A. Wall Mounted Microprocessor Controller:

1. Liquid crystal digital display indicating: Operating mode, setpoint temperature, room temperature, timer setting, fan speed and airflow direction.
2. Self diagnostic fault indication.
3. 24 hour on-off timer.
4. Previous setpoint memory feature.

B. Low ambient protection kit with wind baffle. Allow unit operation down to -20°F.

C. Auto restart following power failure.

D. Pre-charged uninsulated refrigerant piping lines.

2.04 DESIGN EQUIPMENT

A. LG.

2.05 ACCEPTABLE MAKE

A. LG, Sanyo, Mitsubishi, EMI, Carrier.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions and so as to be compatible with intent of the respective system performance requirements.

B. Connect condensate drain indicated on drawings and route to room G004.

C. Provide refrigerant piping and control wiring.

D. Provide any and all necessary control wiring.

END OF SECTION

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SECTION 23 82 16.11
COILS

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Submit product data for on coils

1.03 GENERAL REQUIREMENTS

A. Provide coils of proper size and rows to fit intended use and capacity as scheduled and specified. Location as shown on Plans. Designed for 125 psi. Same end or opposite end connections as required to fit installation shown on Plans. Vertical mounted coils shall have bottom drain headers. Duct mounted coils shall be equipped with flanges. Tag each coil at factory giving number and location. Coils completely drainable with auxiliary drain headers, if necessary. Minimum 1/2 in. drain and vent connections. Aluminum fins shall be a minimum of .0075 in. thick unless otherwise noted. Coils shall have brazed return "U" bends; bent tubes are not acceptable. Performance certified in accordance with ARI Standard 410.

## PART 2 - PRODUCTS

2.01 REHEAT COILS

A. Tubing shall be .025 in. thick copper and shall have a minimum outside diameter of 5/8 in. Fins shall be of aluminum and wound on tubing individually. Steel headers and galvanized steel casings. Coils shall be tested by subjecting each coil to a minimum air pressure of 250 psig with the coil submerged in water.

B. Design Equipment: Trane.

C. Make: Aerofin, Carrier, Daikin Applied, Trane, Heatcraft, Marlo

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions and so as to be compatible with intent of the respective system performance requirements. Provide supporting ironwork and sheet metal safing to assure proper installation without any bypass air around coil.

B. Provide ample space during installation to allow for the removal of the coil. Provide all necessary unions, isolation valves, flexible connectors and accessories to allow for the removal and service of the coil.

C. Provide an access door upstream of all coils for inspection. Access door shall be minimum 16 x 12.

END OF SECTION 23 82 16.11

SECTION 23 82 35
GRAVITY HEATING EQUIPMENT (HYDRONIC)

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Submit product data on gravity heating equipment with color selection chart. Clearly indicate which equipment is being submitted.

## PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All equipment shall be free from expansion, noises and strains. Exposed parts to be cleaned and parkerized or phosphate coated before prime coating or baked enameling. Finish colors as selected from manufacturer's standard colors during the submittal process. Factory-boxed and tagged by room numbers. Access doors shall be provided in cabinet at locations of valves, flow balancers and air vents. Verify at site, the space available for each piece of equipment. Top of heating unit enclosures shall be at least 1 in. below top of windowsill. Bottom of heating unit enclosures, unless otherwise called for, approximately 6 in. above floor and above the base molding. Refer to Architect at once, any correction, discrepancy or suggested change in size or location.

B. Ratings of elements shall be in accordance with approved I=B=R test methods.

2.02 FIN RADIATION

A. General Requirements:

1. Complete enclosure, continuous supporting channel backplate, heating element, hangers and accessories, as specified and shown on the Contract Drawings.

2. Enclosures to run from wall-to-wall unless otherwise called. Provide necessary corner pieces, end caps, column enclosures, butt trims, wall sleeves, with access doors. Do not leave any enclosure installed without an end trim piece.

B. Heating Element:

1. Hot Water System: Seamless copper tube with non ferrous fins, 125 lbs. minimum hydrostatic test pressure. .020 in. tube wall thickness, minimum. .020 in. fin thickness, minimum.

2. Tube mechanically expanded to fin collars for permanent metal to metal contact.

3. Properly support with pitch adjustment. Silent element and pipe support. Locate a maximum of 2 ft. 0 in. apart. Support shall allow for lateral movement for expansion and contraction of heating equipment.

C. Enclosures:

1. Enclosure fronts, 18 gauge furniture steel.

a. Sloping top with stamped grille as scheduled on drawings.

b. Edges and corners rounded. Individual sections not over 6 ft. No exposed areas shall have sharp edges.

c. Mechanically fastened to wall bracket.

d. Continuous interlocking slip joint fit between adjoining covers. Finish shall match enclosure fronts along entire male and female sides.

e. Enclosure accessories shall fit tight to wall at sides, in back plate at top and extend back and mechanically screw to wall at bottom.

2. Support channel full backplate and supports:

a. 20 gauge securely fasten to wall.

b. Enclosure front braced by internal channel braces. Minimum on either side of joint seam.

c. No sheet metal screws or other fastening devices shall be visible.

d. Provide wall brackets or stiffening supports adjacent to each joint and at least every 16 in., maximum 24 in. O.C.

3. Top of cover rest on backplate only and not between wall and backplate.

4. Accessories:

a. Pedestal brackets or bottom panel when required for style.

b. With worm gear driven damper control and knurled aluminum knob, where automatic control is not specified.

D. Design Equipment: Rittling.

E. Make: Rosemex, Sterling, Rittling, Vulcan.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Each unit isolated with shut-off ball valves to permit servicing. Provide flow balancer for each unit as detailed. Contractor responsible for correct end connections and arrangements. Arrange piping accessories and valving fully accessible for servicing. Enclosures fastened to structure with screws or bolts, no

nailing allowed. Fasten at 6 in. O.C. Provide air collecting chamber and manual vent on return end of each heating unit on all upfeed hot water installation.

END OF SECTION

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SECTION 23 82 39
UNIT HEATERS AND CABINET UNIT HEATERS (HYDRONIC AND ELECTRIC)

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation and related work as shown on the Contract Documents.

1.02 SUBMITTALS

A. Submit product data for unit heaters and cabinet unit heaters.

## PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Free from expansion and contraction noises and strains. Fan speed shown on Schedule shall not be exceeded. Each piece of equipment shall be factory-boxed and tagged by room number. Cabinet unit heaters and unit heaters shall have baked enamel finish with color selected by the Architect from manufacturer's standard colors. Rating in accordance with standard test codes adopted jointly by IUGA and ASHRAE.

2.02 UNIT HEATERS

A. General:

1. Wall hung or ceiling suspended.
2. Access for servicing the heating element, motors, and controls.
3. Horizontal discharge units with adjustable horizontal and/or vertical outlet vanes.
4. Vertical units with adjustable outlet louvers or diffusers.

B. Fan and Motor:

1. Statically and dynamically balanced.
2. Motor shall be totally enclosed and designed for continuous operation. Lubrication shall be sealed-in, permanent type.
3. Wall Mounted line voltage thermostat.

C. Heating Element (Hydronic):

1. Serpentine coil, copper tube, aluminum fins, back or side connections to fit headroom requirements.

D. Accessories:

1. Finger proof fan guard.

2. Unit mounted disconnect switch.

E. Hydronic:

1. Design Equipment: Modine.
2. Acceptable Makes: Daikin Applied, Airtherm, Dunham-Bush, McQuay, Sterling, Trane, Vulcan.

2.03 CABINET UNIT HEATERS

A. General:

1. Rough-in dimensions must not exceed those of design equipment.

B. Cabinet:

1. Front and exposed parts, 16-gauge metal with baked enamel finish, all others, 18 gauge steel. Architect shall select color from mano factures standard colors
2. Fronts shall be removable for access to interior parts.
3. Recessed or semi-recessed equipment to have four-side overlap, trim strips not acceptable.

C. Fan And Motor:

1. Fans, forward curved, centrifugal type, direct drive from motor shafts.
2. Driven by totally enclosed motor with overload protection and lifetime lubrication.
   a. Integral manual motor starter.
3. Shall be quiet in operation, not to exceed 45 db measured 5 ft. away, at high speed.
4. Throwaway filter.
5. Key lock control access door(s).

D. Heating Element (Hydronic):

1. Nonferrous construction, copper tube, aluminum fins.
2. Multipass serpentine design for high temperature drop.
3. Manual air vent. Automatic air vent is not acceptable.

E. Control and Piping Accessories:

1. Wall mounted line voltage thermostat.
2. Unit mount fan speed switch.

F. Hydronic:

1. Design Equipment: Trane.
2. Acceptable Makes: Airtherm, Dunham-Bush, McQuay, Sterling, Trane, Vulcan.

## PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Provide equipment in accordance with manufacturer's printed instructions. Report untrue walls before installation. Report cases where clearance below suspended heaters is less than 7-1/2 ft. Provide clearance for piping and conduit. Support units independent of piping. Support units from building structure, with screws or bolts, no nailing allowed. Be responsible for proper location and size of recesses. Coordinate installation of recessed or semi-recessed equipment in recesses. Provide framing in recess and shims. Use sponge rubber gasket air-seal between front enclosure and wall.

3.02 INSTALLATION - HYDRONIC

A. Provide valves and accessories and arrange to permit servicing. Coordinate correct end connections and coil arrangements.

END OF SECTION

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SECTION 26 05 01
BASIC MATERIALS AND METHODS

## PART 1 - GENERAL

1.01 DESCRIPTION

A. The drawings are diagrammatic, unless detailed dimensioned drawings are included, and show only approximate locations of equipment, fixtures, panelboards, conduits, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Exact routings of conduit shall suit the job conditions.

B. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, the size and the quantity of branch circuit conductors, and the panel board or interconnection box from which the branch circuit is served.

C. Make measurements at the site and in the building during construction for all systems installed as the work progresses in such a manner that the equipment, piping, vents, ducts, conduit, and boxes will fit in the space available. Maintain headroom and if in unfinished areas, be as neatly installed, as obscure and "out-of-the-way" as physically possible. 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. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. 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.

D. Any changes in the size or location of the material or equipment supplied, 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 Owner's Representative and approval received before such alterations are made.

1.02 QUALITY ASSURANCE

A. Electric equipment shall be installed in a neat and workmanlike manner. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.

B. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equal in every way to that of the equipment

specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.03 SUBMITTALS

A. Submit product data for the following equipment, materials and products, including all fittings and accessories:

1. Conduit
2. Expansion Fittings
3. Wireway and Wire Trough
4. Channel Support Systems
5. Conductors
6. Terminal and Equipment Cabinets
7. Wiring Devices Including Dimmers
8. Telephone/Data Communication Outlets
9. Television Outlets
10. Boiler Shutdown Switches
11. Underground Pullboxes (Handholes) and Covers
12. Water Proofing Seals
13. Flashing, Sealing, Firestopping Materials
14. Testing reports prior to energizing equipment and materials.

**PART 2 - PRODUCTS**

2.01 MATERIALS

A. Conduit, Raceway and Tubing:

1. Rigid Metal Conduit (RMC) shall be hot-dipped galvanized or electro-galvanized steel, UL listed "rigid metal conduit."
   a. Acceptable Manufacturers:
      1) Republic Conduit
      2) Allied Tube and Conduit
      3) Wheatland Tube Company
      4) Approved equal
2. Electrical Metallic Tubing (EMT) shall be electro-galvanized steel; UL listed.
   a. Acceptable Manufacturers:
      1) Republic Conduit
      2) Allied Tube and Conduit
      3) Wheatland Tube Company

4) Approved equal

3. Flexible Metal Conduit shall be constructed one continuous length of electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges. Shall be UL listed "flexible metal conduit" or "liquidtight flexible metal conduit" as required.

a. Acceptable Manufacturers:

1) Republic Conduit

2) Allied Tube and Conduit

3) Wheatland Tube Company

4) American Flexible Conduit Company

4. Rigid Non-Metallic Conduit (Schedule 40 for concrete encasement, Schedule 80 for direct burial or where exposed) shall be UL listed "rigid non-metallic conduit" for application in underground, encased, and exposed applications in accordance with the NEC". The conduit shall be made from polyvinyl chloride (PVC) and shall be rated for 90ºC conductors. Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3, UL-651 and UL-514.

a. Acceptable Manufacturers:

1) Carlon

2) Heritage Plastics

3) PW Eagle

B. Conduit Fittings:

1. Fittings for rigid metal conduit shall be fully threaded and shall be of the same material as the respective raceway system. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2 in. and double screw indenter fittings for conduits 2 in. and larger. Connectors shall also have insulated throat or plastic insulating bushing up to and including 1 in. size. For sizes 1-1/4 in. and larger, provide plastic insulating bushing. Die-cast, pressure cast fittings shall not be used. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.

a. Acceptable Manufacturers:

1) O.Z. Gedney

2) Steel City

3) Thomas & Betts

4) Crouse-Hinds

5) Carlon

2. Expansion Fittings shall be watertight, combination expansion and deflection type designed to compensate for movement in any direction. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless steel bands, use aluminum body fittings for rigid aluminum conduit.

   a. Acceptable Manufacturers:

      1) Crouse-Hinds, Type "XD"
      2) O.Z./Gedney, Type "DX"
      3) Approved equal

C. Wireway and Wire Trough:

1. Wireway and Wire Trough shall be hinged cover type wireway with provisions for full lay-in along the entire length of run. Wireway shall be steel, enclosed with gray enamel finish. Provide NEMA 1 units for interior/dry/clean locations and NEMA 12 for interior dry maintenance/shop/utility locations. Size to meet NEC fill requirements or larger as noted on Contract Documents. Provide knockouts along runs. Recess in wall where required for flush mounted equipment. Hinge shall be on the bottom of front face for horizontal mounting. Provide all elbows, tees, pullboxes, fittings, hangers, reducers, supports, supports, etc., to meet installation requirements.

   a. Acceptable Manufacturers:

      1) Square D "Square Duct"
      2) General Electric
      3) Hoffman
      4) Meco

D. Channel Support Systems:

1. Channel Support Systems shall be provided for racking of conduit, trapeze suspensions, equipment support, cable racks and panel racks. Provide poured-in-place inserts for supporting channels at poured concrete walls and ceilings. Channel shall be steel with electroplated zinc finish for interior dry locations. Provide necessary accessories such as bolts, screws, anchors, connection plates, and straps as required to perform the necessary functions. Wet location and exterior channel support systems shall be steel with hot dipped galvanized finish and stainless steel hardware as a minimum. Cut ends shall be touched up with suitable matching finish.

   a. Acceptable Manufacturers:

      1) Unistrut
      2) Globe
      3) Kindorf
      4) B-Line

E. Conductors and Cables:

1. Conductors shall be insulated for 600 volts, unless otherwise noted, and shall be standard AWG and kcmil sizes. Conductors shall be 98% copper, thermal plastic or cross-linked polymer insulated, heat and moisture resistant. Conductor sizes No. 18 AWG and smaller shall be a solid single strand; No. 16 AWG and larger shall be multiple stranded. Minimum conductor size shall be #12 AWG except smaller sizes may be used for communications and special systems. Conductor sizes shall be as called for. Conductors shall be labeled with UL seal and be marked with the manufacturer's name, wire size and insulation type. Insulation for all 600 volt conductors shall be Type THHN/THWN-2 or Type XHHW-2, unless otherwise noted. All exterior and underground conductors shall be XHHW-2. Luminaire fixture wire shall conform to the latest Underwriters Laboratories requirements. Flexible cords and cables for general portable use shall be Type SO or SOOW or as noted. Cables for special use shall be of the type specified for the application.

   a. Color Coding:

      1) All circuits shall be color coded according to the following schedule.

| | **Three Phase 120/208V** | **Three Phase 277/480V** |
|---|---|---|
| Ground | Green | Green |
| Neutral | White | Gray |
| A or L1 | Black | Brown |
| B or L2 | Red | Orange |
| C or L3 | Blue | Yellow |

   b. Acceptable Manufacturers:

      1) General Cable
      2) Prysmian
      3) South Wire
      4) Okonite
      5) Senator

2. Metal Clad, Type "MC" Cable shall consist of thermal plastic insulated copper conductors of size and quantity indicated, protected by a positive interlocked armor of galvanized steel. The conductors shall be twisted together and shall have an overall moisture and fire resistant fibrous covering. The cable shall have an integral green insulated full size equipment grounding conductor running its entire length. Where dimming is called for the cable is allowed to include dimming control wiring with a

voltage rating to match the power. The cable shall meet the requirements of the NEC for "Type MC" Metal Clad Cable and shall bear the UL Label.

a. Acceptable Manufacturers:

1) Southwire

2) AFC Cable

3) Approved equal

F. Terminal Lugs and Connectors:

1. The lug shall be capable of continuous operation at the current rating of the cable it is used on. The lug shall be UL listed per UL 486A, using industry standard crimping tools and dies. Terminal lugs shall be solderless, pressure type with UL label for "CU/AL" conductor terminations. The lug shall be a closed-end compression (crimp) type, constructed of seamless, alloy suitable for copper and/or aluminum conductors to match the conductor. The lug shall be made with a chamfered inside end, for ease of conductor insertion. Both one and two hole lugs shall be NEMA sized for standard stud sizes and spacing. The lug shall be designed for use at the system voltage.

a. Acceptable Manufacturers:

1) 3M Scotchlok 30,000 and 31,000 Series

2) Burndy

3) O.Z./Gedney

4) Thomas and Betts

2. The conductor connection shall be capable of continuous operation at the current rating of the cables it is used on. The connection shall be UL listed per UL 486A, using industry standard crimping tools and ides. The connector shall be an inline compression (crimp) type, constructed of seamless, tin-plated copper. The connector shall be constructed with chamfered inside-ends and with center cable stops. The connector shall be designed for use at the system voltage.

a. Acceptable Manufacturers:

1) 3M Scotchlok 10,000 and 11,000 Series

2) Burndy

3) O.Z./Gedney

4) Thomas and Betts

3. "Split-bolt" Connectors shall be solderless type.

a. Acceptable Manufacturers:

1) Burndy

2) Kearney

3) O.Z./Gedney

4) Thomas and Betts

5) Anderson

4. "TWIST ON" Connectors shall be spiral steel spring type and insulated with vinyl cap and skirt.

a. Acceptable Manufacturers:

1) 3-M Company "Scotch-Lok"

2) Ideal "Wing-Nuts"

3) Approved equal

G. Boxes:

1. Outlet boxes shall be galvanized steel, not less than 2-1/2 in. deep, unless restricted by the surroundings, 4 in. square or octagonal, with knockouts. Boxes and associated fittings, plates and devices shall be mechanically fastened (screwed), friction fitting is not acceptable. Outlet boxes exposed to moisture, surface mounted, exterior, wet or damp locations shall be cadmium cast alloy complete with external threaded hubs and gasketed screw fastened covers. Minimum box size shall be as indicated in the NEC for the conductors and devices installed. Boxes shall be approved for the environmental condition where they will be installed.

a. Acceptable Manufacturers:

1) Steel City

2) Raco

3) Appleton

4) Crouse Hinds

2. Telephone/Data Communications Outlet Boxes:

a. 4 in. x 4 in. outlet box with single gang plaster ring with blank cover plate and conduit routed to accessible ceiling space. Cover plate shall match the receptacle cover type.

3. Pull and junction boxes shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type covers. Boxes installed in damp or wet locations shall be of raintight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated NEC for conduit and conductor sizes installed. Boxes shall be approved for the environmental condition of the location where they will be installed.

a. Acceptable Manufacturers:

1) Hoffman

2) Keystone

3) Approved equal

H. Wiring Devices:

1. Wiring Devices (toggle switches, key switches, receptacles, dimmers, occupancy sensors, etc.) shall be specification grade as a minimum. Switch handle and receptacle face finish shall be as directed by the Architect. Provide device cover plates of rounded nylon colored to match the device in finished areas and rounded raised (Steel City 450/460 series) only for surface mounted locations in unfinished areas. Provide neoprene gasketed cast aluminum/zinc box with hinged (for receptacle) rain tight cast aluminum/zinc lockable while in use cover with stainless steel hardware for devices designated "WP".

   a. Acceptable Manufacturers:

      1) Pass and Seymour

      2) Hubbell

      3) Leviton

2. Toggle/Snap Switches:

   a. Units shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, side/back wired, with nylon/polycarbonate toggle, self-grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20. Single pole units shall be Hubbell HBL1221, P&S 20AC1 or Leviton 1221-2. Provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model.

3. Receptacles:

   a. Provide receptacles where indicated on the drawings and where called for. Provide type receptacle as indicated and if not indicated then utilize general receptacle.

   b. General Receptacle: Units shall be NEMA 5-20R, duplex, 20A, 125V, side/back wired, #14 to 10AWG screw terminals with nylon face, indented brass contacts for three point connection, self-grounding stainless steel mounting screw clip plate and green ground terminal. Shall meet requirements of Federal Specification W-C-596, NEMA WD-6 and UL 498.

      1) Units shall have 0.03" thick brass contacts, 0.04 inch galvanized steel mounting strap and be: Hubbell BR20, P&S BR20 or Leviton BR20.

   c. Ground Fault Interrupting Receptacles: Units shall be as specified above for General Receptacle and have 5mA interrupting ground fault level, test/reset front buttons, full through feed capability, power off on reverse wired sensing, 10kA short circuit current rating, be tamper/weather resistant and in compliance with UL 943. Unit shall self-test function to periodically test the components automatically and indicate a failure condition utilizing

an LED. Shall be Hubbell GFR5362, P&S 2096TR or Leviton S7599TR.

d. Stove Receptacles: To be NEMA 14-50R single receptacle in suitable box and steel cover plate painted to match the surrounding. Shall be Hubbell, P&S or Leviton highest grade available.

e. Special Receptacles: provide other type receptacles as indicated herein or on the drawings. Such receptacles shall be Hubbell, P&S or Leviton highest grade available.

4. Television Outlets:

a. 4 in. x 4 in. outlet box with single gang plaster ring with blank cover plate and conduit routed to accessible ceiling space. Cover plate shall match the receptacle cover type.

5. Emergency Shutdown Pushbutton:

a. Where called for provide emergency shutdown/emergency power off push button. Unit shall be Square D Class 9001 Type K NEMA 13 oil tight pushbutton with the following:

1) Red mushroom head 1-1/2 in. button, hinged protective flip up cover, push to operate, pull to reset.

2) Maintained contact operation with one normally open and one normally closed 10A 120V contacts. Provide relay for additional contacts.

3) Red pilot light.

4) Engraved legend plate indicating "XX - Emergency Stop" with XX = the system name.

I. Underground Pullboxes (Handholes):

1. Sidewalk and Grass Areas: Boxes shall be comprised of composite material with stainless steel hardware and ANSI Tier 8 rating minimum. Provide conduit/duct openings per the plans/schematics with spare capacity for 2 - 2" in each side wall, minimum. Box shall be minimum 2'-0" wide x 2'-0" long x 3'-0" deep inside dimensions, or larger as required to meet NEC requirements. Cover shall be imprinted with either "Electric", "Telephone", etc. to designate type of service. Provide 18 in. of #2 crushed stone under pullbox and 18 in. beyond. Refer to drawings per details and locations.

a. Manufacturers:

1) Quazite

2) Old Castle

3) Approved equal

2. All Other Areas: Boxes shall have ANSI Tier 22 rating (22,500lb weight rating) and be comprised of steel reinforced concrete walls and bottom

sections using 5,000 psi, minimum concrete. Bottom shall have 12 in. diameter sump opening and 3/4 in. ground rod opening. Knockouts and openings shall be positioned for conduits/ducts. Provide two (2) rows of anchor bolt inserts for cable rack supports to permit installation of two (2) cable rack supports on each side wall and one (1) cable rack support on each end wall. Provide hot dipped galvanized steel pulling irons at 45° angle between floor and wall opposite each opening. Provide 24 in. x 24 in. opening for frame and cover and a suitable masonry "Throat" between top of box and cover frame to allow for variation in final finished grade. Frame and cover shall be case iron. Box shall be minimum 2'-0" wide x 2'-0" long x 3'-0" deep inside dimensions, or larger as required to meet NEC requirements. Cover shall be imprinted with either "Electric", "Telephone", "Medium Voltage Electric", etc. to designate type of service. Unit shall be rated to AASHTO HS20-44 loading. Provide 18 in. drywell of #2 crushed stone under pullbox and 18" beyond. Provide 4 in. drain to local site daylight. Refer to drawings per details and locations.

a. Manufacturers:

1) Pullbox: Lakelands precast.

2) Cover: Neenah Foundry Company, roadway type.

3) Approved equal.

J. Ductbanks:

1. Ductbanks shall be rigid non-metallic conduit system. Provide all sleeve joints, couplings, bend sections, bends, elbows, offsets, angle couplings, bell ends, caps, base spacers and intermediate spacers as required to meet field conditions. All bends, stub-ups and wall, slab or floor-building penetrations shall be rigid steel conduit without exception.

K. Waterproofing Seals:

1. Provide expanding link type seal, for installation between duct/conduit, and sleeve or core-drilled hole in concrete.

2. Make: Link Seal, manufactured by Thunderline Corp., or approved equal.

L. Flashing, Sealing, Fire-stopping:

1. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

a. Provide materials and products listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.

b. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly.

Provide fire-stop seal between sleeve and wall for drywall construction.

c. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

d. The methods used shall incorporate qualities, which permit the easy removal or addition of electrical 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.

2. Acceptable Manufacturers:

a. Dow Corning Fire-Stop System Foams and Sealants

b. Nelson Electric Fire-Stop System Putty, CLK and WRP

c. S-100 FS500/600, Thomas & Betts

d. Carborundum Fyre Putty

e. 3-M Fire Products

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Unless otherwise noted, wiring for all systems indicated in the contract documents shall consist of insulated conductors installed in raceways. Raceways shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond raceways to all boxes and cabinets so that each system of raceways is electrically continuous throughout. Unless otherwise indicated on the drawings, install all wiring in the following raceway system:

1. Wiring 600 Volts or Less in Dry Locations: Electrical metallic tubing.

2. Wiring 600 Volts or Less in Outdoors, Above Grade Locations: Rigid metal conduit.

3. Wiring 600 Volts or Less Installed Below Grade, in Concrete Floor Slabs or Below Ground Floor Slab: Rigid non-metallic conduit encased in concrete with rigid metal conduit bends and penetrations through building floors and walls.

4. Flexible metal conduit shall be used for final connection to all motors, final connection to rotating or vibrating equipment, final connections to dry type transformers and final connections to recessed lighting fixtures. Liquidtight flexible conduit shall be used in all wet or damp locations. Maximum length of flexible conduit shall be 36 in., except that from outlet boxes to lighting fixture maximum length shall be 6 ft. Provide green insulated equipment grounding conductor in all flexible metal conduit.

5. Where allowed, branch circuits may be type MC cable between homerun junction box and equipment/device connection in drywall partitions only. Homerun junction box to be a maximum of 20 ft. from equipment/device.

B. Raceways:

1. Sized as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, and type of the insulation conductors to be installed. Raceways shall be minimum 3/4 in. trade size for branch circuit wiring and minimum 3/4 in. trade size for all telephone intercommunications, instrumentation, fire alarm, television and computer systems and for all branch circuit "Home Runs" to panelboards.
2. Installed to provide adequate grounding between all outlets and the established electrical system ground.
3. Cut square, free of burrs due to field cutting or manufacture, and bushed where necessary. Bolt length shall not extend more than 1/4 in. beyond a nut.
4. Installed with exterior surfaces not less than 6 in. from any surface with normal operating temperature of 200°F or higher.
5. Plugged at the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.
6. Concealed throughout except where exposure is permitted by the Owner's Representative. All exposed raceways shall be painted to match existing adjacent surface finish as directed by the Architect.
7. Installed parallel or perpendicular to floors, walls and ceilings where exposed wiring is permitted.
8. Installed with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the raceway. Factory made bends are acceptable and should be considered for raceways larger than 2 in.
9. Installed with UL approved rain-tight and concrete-tight couplings and connectors.
10. Firmly fastened within 3 ft. of each outlet box, junction box, cabinet or fitting. Raceways shall not be attached to or supported by wooden plug anchors or supported from mechanical work such as ductwork, piping, etc.
11. Installed with a #14 AWG fish wire in all telephone, intercommunication, "Spare" or "Empty" conduit runs to facilitate future installation of conductors.
12. Installed with expansion fittings at all building expansion joints such that no undue stress is placed on any electrical raceway due to the proper functioning of expansion joints.
13. Arranged in a neat manner for access and allow for access to work installed by other trades.

14. Raceways installed in concrete slabs shall be located so as not to affect structural integrity of slab, and such that conduit shall have a minimum of 1 in. of concrete cover on all sides. Obtain approval from the Owner's Representative prior to installing conduit larger than 1 in. trade size in concrete slabs. Raceways in slabs shall be for floor box use only, or routing vertically through.

15. Raceways installed below ground floor slab shall be 6 in. minimum below slab with pea stone (NYSDOT 0702-0203) all sides. Where possible, install conduit directly below slab with concrete envelope poured monolithic with slab. Where this is not possible, support raceways and envelop maximum 5 ft. - 0 in. on centers from underside of structural slab by means of galvanized pipe hangers. Pipe hangers shall be coated with asphalt mastic. Installation shall maintain integrity of waterproofing membrane.

16. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.

17. Become familiar with the general construction of the building and place sleeves, inserts, etc., as required. All penetrations through existing floors shall be core drilled and sleeved.

18. Wherever a cluster of four (4) or more raceways rise out of floor exposed, provide neatly formed 6 in. high concrete envelop, with chamfered edges, around raceways.

19. All raceways shall be supported adequately by malleable iron pipe clamps or other approved methods. In exterior or wet locations, supports shall allow not less than 1/4 in. air space between raceway and wall. Firmly fasten raceway within 3 ft. of each outlet box, junction box, cabinet or fitting. The following table lists maximum spacing between conditions, strength of supporting members, etc.

20. Furnish and install such supports at no additional cost to owner.

| **Conduit Trade Size** | **Type of Run** | **Horizontal Spacing in Feet** | **Vertical Spacing in Feet** |
|---|---|---|---|
| 3/4 in. | Concealed | 7 | 10 |
| 1 in., 1-1/4 in. | Concealed | 8 | 10 |
| 1-1/2 in. and larger | Concealed | 10 | 10 |
| 1/2 in., 3/4 in. | Exposed | 5 | 7 |
| 1 in., 1-1/4 in. | Exposed | 7 | 8 |

| Conduit Trade Size | Type of Run | Horizontal Spacing in Feet | Vertical Spacing in Feet |
|---|---|---|---|
| 1-1/2 in. and larger | Exposed | 10 | 10 |

21. Where raceways puncture roof, install pitch pockets as required in order that the roof warranty is maintained. Coordinate with representative of roofing material manufacturer.
22. At each flush mounted panelboard, terminal cabinet, control cabinet, etc., provide four (4) spare 3/4 in. raceways from panelboard, etc., to an area above the nearest accessible ceiling space. Make 90° turn above the ceiling, arranged for further continuation of raceway, and cap.
23. Provide a bushing at each conduit termination unless fitting at box where conduit terminates has hubs designed in such a manner to afford equal protection to conductors. Provide grounding type insulated bushings on all conduit sizes 2 in. trade size and larger and on all feeder raceways regardless of size. Provide standard bushings for conduits 1 in. and smaller unless otherwise stated.
24. Differing Temperatures: For raceways routed between areas with differing temperatures (interior to exterior, walk in coolers/freezers, environmental chambers, etc.) install raceway as follows:
    a. Provide a thermal break, 4 in. minimum of stainless steel conduit within space wall/separation.
    b. Seal raceway penetration through the wall/separation.
    c. Provide a box on each side of the space wall/separation.
    d. Provide raceway interior sealant (duct seal or suitable foam) to provide a complete air barrier after conductors are installed.
    e. Mounting of raceway and boxes on equipment shall be coordinated and approved by the equipment manufacturer.
25. Raceway installed in wet/damp locations or on exterior walls shall have a spacer manufactured for this purpose provided to maintain a space/void between the mounting surface and the raceway.

C. Underground Raceways and Ductbanks:

1. Encase all underground raceways in concrete, sand (NYSDOT 0733-15), No. 1 crushed stone (NYSDOT 0703-02) or pea stone (NYSDOT 0702-0203). Concrete encasement shall be utilized where indicated and for circuit voltages over 600V. For concrete encasement, form concrete envelope around raceways, 3 in. minimum thickness concrete at top, bottom and sides of raceways, conduits on 7-1/2 in. centers both directions with concrete between raceways. Top of concrete envelope shall be finished not less than 24 in. below finished grade, except where under building slabs. Open trench for its complete length before concrete is

poured; if any obstructions are encountered, make provisions to avoid them. Support raceways minimum 3 in. above bottom of trench before pouring. Furnish and install precast concrete, plastic or fiber spacers. Stagger couplings. When concrete is specified, securely tie raceways in place to prevent floating. Pour concrete as soon as possible after placing and securing of raceways. Pull iron-shod mandrel, not more than 1/4 in. smaller than bore of raceway to remove concrete and other obstructions. Clean raceway by drawing through properly sized cylindrical brushes as many times as necessary to remove dirt. Concrete envelopes shall contain reinforcing rods wherever non-metallic raceways are used. Reinforcing shall be continuous runs of No. 4 deformed rods located in all four corners as well as top and bottom of envelope between each raceway. In locations where non-metallic raceways are used, change to heavy wall metallic conduit (RMC) of same internal diameter before rising out of ground and at bends/elbowes; provide metallic conduit elbows at conduit rise. Carry concrete envelope to a point 12 in. minimum above grade or floor slab at rise point if allowed by site conditions and equipment to be installed. Slope top of concrete away from raceway, chamfer edges. Cap all empty conduits watertight. Place conduit in straight lines. Seal, completely waterproof, all duct joints before encasement. Place direct-bury conduit tier-by-tier method, backfilling each layer to achieve proper spacing utilizing suitable encasement material. Trench backfill shall be in 6" lifts maximum and compacting between. Backfill to be excavated material with rock and organic material removed. For grass locations provide 8" minimum off site topsoil (NYSDOT 0713.01) and seed to match the existing. Other surfaces shall be returned to the original or better condition to the existing surrounding. Elbows shall have a minimum radius of 42 in. Follow proper low temperature installation procedures as recommended by raceway manufacturer. Provide detectable marking tape in soil above all ductbank sand buried conduit. Repair or replace all existing utilities and facilities damage, due to ductbank installation, as part of contract. Where raceways pass between exterior and interior and terminate in building, switchgear, pullbox, etc. provide conduit sealing bushing (O-Z Gedney CSB or approved equal) in each raceway to fill all voids around conduit and cables. Upsize the conduit as needed for suitable sealing bushing.

D. Wiring Methods:

1. Conductors shall not be installed until raceway system, including all outlets, cabinets, bushings and fittings, is completed. Verify that all work of other trades which may cause conductor damage is completed. Use only U.L. approved cable lubricants when necessary. Do not use mechanical means to pull conductors No. 8 or smaller.

2. In general, conductors shall be the same size from the last protective device to the load.

3. All wiring systems shall be properly grounded and continuously polarized throughout, following the color-coding specified. Connect branch circuit wiring at panelboards, as required, in order to provide a "balanced" three-phase load on feeders.
4. Provide insulated green ground conductor in each branch circuit.
5. All feeder connections shall be made to bus and other equipment using solderless, pressure type terminal lugs.
6. Branch circuits connected to a 20A circuit breaker shall be sized as indicated except for lengths exceeding 75 ft. For circuits longer than 75 ft. to 100 ft. utilize No. 10 AWG conductors (line, neutral and ground) and for circuits from 100 ft. to 150 ft. utilize No. 8 AWG (line, neutral and ground) unless otherwise indicated. Conduit size shall be modified in accordance with the NEC.
7. For splices and taps, No. 10 AWG and smaller, use solderless "twist on" connectors having spiral steel spring and insulated with a vinyl cap and skirt.
8. For splices and taps, No. 8 and larger, use insulated solderless set screw AL/CU or hydraulically compressed sleeve fittings suitable for the intended use.
9. Use cast connections for ground conductors.
10. Provide minimum 6 in. of spare/slack of each conductor in each junction or pull box and termination.
11. Make all splices and connections in accessible boxes and cabinets only.
12. Cover uninsulated splices, joints, and free ends of conductor with rubber and friction tape of PVC electrical tape. Plastic insulating caps may serve as insulation. Heat shrink sleeves shall be acceptable for crimp type splices.
13. On termination at branch circuit outlets, leave a minimum of 8 in. free conductor for installation of devices and fixtures.
14. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner's Representative and receive written approval for splicing prior to installation of feeder(s). Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors as near equal as possible.
15. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equal.
16. Lighting fixtures, detectors, etc., in mechanical equipment, boiler and pump rooms shall be installed with exposed wiring after equipment, ductwork, piping, etc., are in place. In general, lighting shall be as located on the drawings; where conflicts exist, locate lights for best distribution.

17. Provide cable/conductor vertical support in accordance with the NEC.

18. Handholes:

    a. Provide cable racks, and securely fasten all cables. Support stanchions shall be spaced 3 ft. apart maximum.

    b. Provide separation of conductors of different systems per NEC requirements.

    c. Pitch all raceways toward the handhole.

    d. Mortar and brick the throats of handholes to grade level. Set cover rim to 1 in. above grass areas and flush with finished areas. Waterproof throat with elastic bituminous plastic cement coating.

E. Outlet Boxes:

1. Consider location of outlets shown on drawings as approximate only. Study architectural, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Owner's Representative for decision prior to installation. Comply with the NEC relative to position of outlet boxes in finished ceilings and walls.

2. Prior to installation, relocate any outlet location a distance of 5 ft. in any direction from location indicated on drawings if so directed by the Owner's Representative. Prior to completion of wall construction, adjust vertical height of any outlet from height indicated if so directed by Owner's Representative. The above modifications shall be made at no additional cost to the Owner.

3. Where outlets at different mounting heights are indicated on drawings adjacent to each other (due to lack of physical space to show symbol on drawings), install outlets on a common vertical line.

4. Where switch outlets are shown adjacent to strike side of door, locate edge of outlet box approximately 3 in. from door frame.

5. Outlet boxes in separate rooms shall not be installed "back-to-back" without the approval of the Owner's Representative.

6. Outlet boxes shall be sized to accommodate the wiring, splices and device(s) to be installed in accordance with the NEC.

7. Outlet boxes installed in plaster, gypsum board or wood paneled hollow cavity walls shall be installed flush with raised plaster covers or raised tile covers. Boxes shall be mechanically fastened and supported by two (2) adjacent structural members (studs) with cross brackets (Garvin Industries Model BMB or approved equal).

8. Outlet boxes installed in tile, brick or concrete block walls shall be installed flush and have extra-deep type raised tile covers or shall be 3-1/2

in. deep boxes with square corners and dimensions to accommodate conductors installed.

9. Surface ceiling mounted outlet boxes shall be minimum 4 in. square, 1-1/2 in. deep, galvanized sheet metal.

10. Surface wall mounted outlet boxes shall be cast type boxes.

11. Install a device cover plate over each and every outlet indicated on drawings. Do not install plates until painting, cleaning and finishing of surfaces surrounding the outlet are complete. Install single one-piece multi-gang covers over multi-gang devices.

F. Receptacles:

1. Ground opening shall be up for vertical installation and on the left for horizontal installation.

G. Toggle Switches:

1. Switches shall be installed in accessible locations near room/space entryway(s).

2. Provide lighted handle switches in mechanical rooms, elevator pits, electric rooms, etc.

3. Switches shall have neutral pulled through the box even if not used.

H. Junction and Pull Boxes:

1. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and size as require by the National Electrical Code.

I. Equipment Mounting Heights: Coordinate with architectural interior and exterior elevations.

1. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:

| | | |
|---|---|---|
| a. | Toggle switches (up position "on") | 46 in. |
| b. | Wall lighting controls (dimmer, digital switch, etc. | 46 in. |
| c. | Receptacle outlets (long dimension vertical, ground" pole farthest from floor) | 18 in. |
| d. | Receptacle outlets above counters | 8 in. above counters |
| e. | Receptacle outlets, above hot water or steam baseboard heaters. Do not install receptacle outlets above electric baseboard heaters | 30 in. |

| | | |
|---|---|---|
| f. | Receptacle outlets, hazardous areas; also for refrigerators | 48 in. |
| g. | Receptacle outlets, weatherproof, above-grade | 24 in. |
| h. | Telephone outlets | 18 in. |
| i. | Telephone outlets, wall mounted | 46 in. |
| j. | T.V. outlet | 18 in. |
| k. | Fire alarm manual stations | 46 in. |
| l. | Fire alarm combination audio/visual and standalone visual device (entire strobe lens at heights indicated) | 80 in. to bottom of the notification device |
| m. | Standalone fire alarm audio device | 90 in. (min) to 96 in. (max) |
| n. | Distribution panelboards, to top of backbox | 72 in. |
| o. | Terminal cabinets, control cabinets, to top of backbox | 72 in. |
| p. | Disconnect switches, motor starters, enclosed circuit breakers. | 48 in. |

2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Owner's Representative for approval to change location before installation.

J. Hangers and Supports:

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, large circuit breakers, pendant mounted lighting fixtures, etc.
2. Panelboards, disconnect switches, circuit breakers, cabinets, large pull boxes, adjustable speed drives, cable support boxes and starters shall be secured to the building structure and not supported from conduits. Small panelboards, etc., as approved by Owner's Representative, may be supported on walls. Racks for support of conduits and heavy electrical equipment shall be secured to building construction by substantial structural supports.

K. Identification:

1. Provide engraved lamicoid identification nameplates on switchboards, main service disconnects, transfer switches, motor control centers and on all panelboards using designation shown in panelboard schedule. Include voltage, phase, equipment served, voltage source to panel or equipment.

2. Provide engraved lamicoid identification nameplates for each circuit breaker in the main distribution panel listing the panelboard or equipment connected to each device.

3. Provide engraved lamicoid identification nameplates on all items of equipment including individual circuit breaker enclosures and disconnect switches, listing the equipment connected to the particular device provided under Specification Section 262000, including, but not limited to: starters, disconnect switches, adjustable speed drives, circuit breakers, etc. Include voltage, phase, equipment served, voltage source to panel or equipment.

4. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker. Directory shall be placed in a plastic clear sleeve in the interior of the panelboard door.Identify junction and pullboxes for particular service and circuit such as power, emergency power, lighting, fire alarm, telephone, interphone, public address, nurse call, etc. using stencil lettering on cover.

5. Using adhesive backed printed tape label (white background, black lettering) all receptacle and switch coverplates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to outside of receptacle or switch coverplates.

L. Spare Parts:

1. Deliver to Owner and obtain receipt for spare parts including key switches, fuses, etc.

3.02 TESTS

A. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform the function for which they are designed. For all feeder and exterior branch circuit wiring rated 600 volts or less, provide 1,000 volt "Megger" insulation test prior to energizing feeders. Use a 1,000-volt motor driven megger for all tests. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors. Document test results and submit for approval prior to energizing conductors.

END OF SECTION

SECTION 26 05 26
GROUNDING

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide grounding system equal to or exceeding the requirements of NEC and as indicated in the contract documents. Raceway system which includes metal conduit, wireways, pullboxes, junction boxes, busway, wire ways, cable trays, enclosures, motor frames, etc., shall be made to form a continuous, conducting permanent ground circuit of the lowest practical impedance to enhance the safe conduction of ground fault currents and to prevent objectionable differences in voltage between metal nonload current carrying parts of the electrical system.

B. Provide solid grounding of building structures and electrical and communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits and systems. Types of grounding systems include the following:

1. Electrical Service and Transformer Grounding
2. Building Grounding
3. Electrical Equipment Grounding

1.02 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions. etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in the NEC by Nationally Recognized Testing Laboratory (NRTL) and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

1.03 REQUIREMENTS

A. Grounding conductors, bonding conductors, jumpers, grounded conductors, etc. shall be sized in accordance with the NEC.

B. Equipment and materials shall be installed in accordance with the manufacturer's recommendations.

C. Provide ground system coordinated with and in accordance with the utility company requirements.

1.04 SUBMITTALS

A. Provide submittals for the following:

1. Ground rods and connectors.
2. Ground bars.
3. Building ground resistance test results.

**PART 2 - PRODUCTS**

2.01 MATERIALS

A. Conductors:

1. Exposed grounding components such as bars, straps, cables, flexible jumpers, braids, shunts, etc., shall be bare copper unless otherwise indicated.
2. Grounding conductors in raceway with 600V circuiting shall be insulated to match the circuit conductors with green color.
3. Grounding conductor size shall be as indicated or as required by the NEC whichever is larger, stranded, soft drawn or soft annealed copper, unless otherwise indicated. Sizing shall take into account circuit voltage drop.
4. Acceptable Manufacturers:
   a. Same make as for 600 volt conductors.

B. Ground Rods:

1. Provide solid copper or copper clad steel cylindrical rods, 3/4 in. minimum diameter and minimum 10 ft. long with pointed end. Provide units suitable for extension connection when ground rods longer than 10 ft. are indicated.
2. Acceptable Manufacturers:
   a. Copperweld
   b. Erico
   c. Burndy
   d. Approved equal.

C. Connectors, Clamps and Terminals:

1. Mechanical connectors and clamps shall be made of copper alloy or silicon bronze. Solderless compression terminals shall be copper, long-barrel, NEMA two bolt. Bolts and washers (Belleville) shall be of comparable material or stainless steel.

a. Acceptable Manufacturers:

1) Burndy

2) Hubbell Anderson Corp.

3) Thomas & Betts

4) Approved equal

2. Exothermic Welds:

a. Provide exothermic welds designed for size and type of intended cable, rods, structure, etc. Solder prohibited for connections, except for medium and high voltage cable metallic tape shields (utilize mechanical and solder).

b. Acceptable Manufacturers:

1) Erico "Cadweld"

2) Burndy "ThermOweld"

3) Approved equal

3. Pipe Clamp:

a. Pipe clamp for bonding to pipe type electrode (water pipe, etc.) shall be a suitably sized copper alloy clamp.

b. Acceptable Manufacturers:

1) Burndy GAR-BU

2) O-Z Gedney Type CG

3) Burndy "Durium"

4) AFL Global "Everdur"

5) Approved equal

4. Flexible Strap:

a. Flexible grounding straps shall be of braided high conductivity copper with two-hole connector. Strap shall have equal to or greater than ampacity of the system it is bonding to. Strap shall provide flexibility in all directions when installed properly.

b. Acceptable Manufacturers:

1) Burndy

2) OZ Gedney

3) Approved equal

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Grounding Conductors:

1. Provide grounding conductor(s) with all power circuits. Conductor shall be sized as indicated or as required by the NEC as a minimum and shall be terminated on the equipment, device, enclosure, etc. grounding terminal. Conductor size shall be for the entire length unless approved by the Engineer where oversized for voltage drop.
2. Conductors above grade to ground electrodes (water piping, structural column, etc.) and to equipment (service entrance, ground bars, ground halos, etc.) shall be installed in metallic conduit with ends bonded to the conduit.
3. Grounding conductors shall be installed to have a minimum radius of 3 in.
4. Grounding conductors in a raceway system shall be terminated/bonded to each box, cabinet, enclosure, etc. through which it passes or terminates.
5. Grounding conductors routed with underground circuits shall be bonded to each ground electrode and metallic cable support system within the raceway system including pull and access locations.
6. Stranded conductors penetrating vapor barriers, foundations, slab on grade and water stop membranes shall have the interstitial spaces between strands filled with solder 4 in. beyond the membrane each side. The conductor shall be sealed to the membrane with a manufacturer approved method.

B. Raceway Systems:

1. All metal supports, cable trays, messenger cables, frames, sleeves, brackets, braces, etc. for the raceway system, panels, switches, boxes, starters controls, etc., which are not rigidly secured to and in contact with the raceway system, or which are subject to vibration and loosening, shall be bonded to the raceway system.
2. Termination of rigid conduit at all boxes, cabinets, and enclosures shall be made up tightly with a double locknut arrangement and a bushing, bushings being of the insulated type. Utilize grounding bushings as specified elsewhere in these specifications.
3. Conduit which runs to or from boxes, cabinets, or enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and hence impair the continuity of system ground circuits shall be provided with bonding jumpers connected between a grounding type bushing/locknut on the conduit and a ground bus or stud inside the box, cabinet, or enclosure and attached thereto.
4. Conduit expansion joints and telescoping sections of metal raceways shall be provided with bonding jumpers sized in accordance with the NEC.

C. Ground Rods:

1. Ground rods shall be driven vertically the full length plus 24 in., minimum.
2. Ground rods shall be located in virgin soil or loamy compacted soil.

3. Provide one (1), minimum, ground rod inspection test well for each ground rod/electrode system or as indicated.

D. Connectors Clamps and Terminals:

1. Connectors utilized above grade in dry accessible locations shall be mechanical or exothermic type.
2. Connectors in damp locations, below grade or if not indicated shall be exothermic type.
3. Clean the area near the connecting surfaces prior to any connection to ensure effective contact. Cleaning shall be to the bare metal. Wire brush area if needed to remove rust scale paint, dirt, etc. to expose bare metal.
4. Exothermic connections shall be installed in accordance with the manufacturer's recommendations and tested with heavy blow of a five pound sledge.

E. Flexible Strap:

1. Flexible straps shall be used when bonding vibrating/moveable equipment, with expansion fittings and where recommended by the manufacturer.
2. Sufficient slack shall be provided to compensate for the anticipated vibration, movement and expansion.

F. Ground Grid:

1. Provide a ground electrode grid consisting of a minimum of three (3) 10 ft. ground rods arranged in a delta configuration with a minimum spacing of 20 ft. apart and connected together.
2. Connecting conductors shall be bare #4/0 AWG minimum, buried a minimum of 24 in. below grade.
3. Connect the ground grid to the building electric service and to the main ground bar.

G. Secondary Electrical Systems:

1. The neutral (grounded) conductor of each low voltage, single and/or polyphase system or distribution system, except special isolated double insulated systems, shall be solidly connected to ground at the transformer neutral bushing, or at the main secondary switchgear to the system ground, and shall be sized for current carrying capacity, not to be less than as required by the NEC. Ground connection shall be to the building grounding system, building steel, building water service, building concrete reinforcement and as indicated.
2. Provide equipment grounding conductor, green colored insulation, with phase conductors, to primary side of all transformers rated 600 volts or less circuited to the enclosure and secondary neutral bushing, to all electrical utilization and distribution equipment; insulation shall be same

type as phase conductors. Transformer enclosures shall be bonded to the primary and secondary circuit grounding conductor.

3. Equipment grounding conductors shall extend from the point of termination back to the ground bus of the source panelboard, switchboard, transformer, or switchgear.

H. Equipment Grounding:

1. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch circuit conductors.

I. Emergency Generators with Three Pole Transfer Switch(es):

1. Generator neutrals are not to be bonded to ground at the generator.
2. Generator neutral shall be connected to the secondary electrical distribution system neutral conductor or bus. Connection shall be made at the transfer switch neutral lug.
3. Generator frames shall be bonded to the ground system with a conductor sized in accordance with the NEC.

J. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors in conduit 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 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.

K. Power Company Requirements:

1. Size #6 ground conductor from service entrance equipment to meter panel.
2. One size 3/4 in. diameter by 10 ft. ground rod and size #6 circuitry at riser pole.
3. Meet power company requirements.

3.02 TESTS

A. Test the building ground system before backfilling to ensure continuity and determine system resistance value.

B. Testing procedure shall be a fall of potential type with a moving auxiliary electrode in accordance with IEEE Standard 142 and reviewed/approved by the Engineer. Sufficient test points shall be taken for accurate resistance value.

C. Make resistance measurements in dry weather, no earlier than 48 hours after rainfall. Provide tabulated test results indicating distance between rods and resistance readings on a plotted graph.

D. Test each ground electrode system separately prior to connection to the system or main building ground bar. Test each system ground electrode system a second time after backfilling has occurred and all final connections (building steel, water service, etc.) have been made.

E. Soil type, date, time, meter manufacturer/model number, person performing the test, test witnesses and most recent rainfall shall be noted in test submittal.

END OF SECTION

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SECTION 26 20 00
ELECTRIC DISTRIBUTION

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide a complete electrical service, and distribution system as indicated on the Contract Documents and as specified herein.

1.02 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

1.03 SUBMITTALS

A. Submit the following product data/information:

1. Manufacturer and equipment type.
2. Standard catalog information sheet.
3. Detailed shop drawings indicating plan, elevation, end and isometric views. Top and bottom conduit areas shall be clearly shown and dimensioned on the drawings.
4. Single-line diagram.
5. Complete Bill of Materials.
6. All relevant ratings including, but not limited to, voltage, current, interrupting and withstand.
7. Overcurrent Device Information. Model number, available settings, setting ranges, capabilities, etc.
8. Submit available and final settings, programming and adjustments.

B. Submit product data and information for the following equipment, materials, products, etc.:

1. Switchboards.
2. Dry type transformer(s) including shielded and linear load transformer(s).
3. Distribution and branch circuit panelboards.
4. Enclosed circuit breakers.
5. Disconnect switches.
6. Meter Centers.
7. Surge Protective Devices.

1.04 WARRANTY

A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 and a minimum of one (1) year from acceptance.

**PART 2 - PRODUCTS**

2.01 MATERIALS

A. Dry-Type Transformers:

1. Transformers to be self-cooled ventilated dry type. Transformers that require internal or external fan assisted forced air cooling to obtain ambient air (AA) rated kVA are not acceptable. Transformers 15 kVA and less shall have 185°C insulation system and shall be designed not-to-exceed 115°C rise above 40°C ambient. Transformers 30 kVA and higher shall have 220°C insulation system and shall be designed not-to-exceed 150°C rise above 40°C ambient. Insulation systems shall be U.L. listed. Cores shall be manufactured from a high-grade, non-aging, silicon steel with high magnetic permeability, low hysteresis and eddy current losses, and shall be clamped with structural angles and bolted to the enclosure to prevent damage during shipment or rough handling. Remove clamping after installation. Coils shall be copper, vacuum impregnated with non-hydroscopic thermosetting varnish and shall have a final wrap of electrical insulating material designed to prevent injury to the magnet wire. Transformers having coils with magnet wire visible will not be acceptable. 30 KVA, and larger, floor mounted. Under 30 KVA, wall mounted. Provide Mason type ND, Korfund or Vibrex vibration isolation devices for each transformer.
2. Ratings: Shall be as indicated on the "Transformer Schedule" or as noted on the drawings. IEEE #C57, NEMA and US Government requirements shall apply. The transformer efficiencies shall meet or exceed the requirements of New York State and the US Department of Energy.
3. For transformers up to 300 kVA, provide with 6-2-1/2% full capacity taps, 2-FCAN (for connections above nameplate) and 4-FCBN (for connections

below nameplate). For transformers above 300 kVA, provide 4-2-1/2% fully rated taps, 2-FCAN and 2-FCBN.

4. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:
   a. Square D
   b. Eaton Corporation
   c. General Electric by ABB
   d. Acme
   e. Heavy-Duty
   f. Howard

B. Distribution Panelboards (Nominal 600 Volt):

1. Provide distribution panelboards as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal magnetic, molded case circuit breakers as scheduled. Shall be NRTL listed for use as service entrance equipment where used at the service entrance.
2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure, main lugs, and main breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50°C rise above ambient.
3. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.
4. Each panelboard, as a complete unit shall have a short circuit rating equal to or greater than the rating shown on the Panelboard Schedule. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. The use of series rating of panelboards for short circuit rating is not acceptable.
5. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets shall be equipped with locks and all locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge, full-finished steel with rust-inhibiting primer and baked enamel finish.
6. The panelboard interior assembly shall be dead front with panelboard front removed. Panelboard front shall be door in door construction with full length piano-hinge. Main lugs or main breakers shall be barriered on five

(5) sides. The end of the bus structure opposite the mains shall be barriered.

7. Panelboards shall be UL listed for use intended.
8. Ratings shall be as indicated in the contract documents.
9. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:
   a. Square D "I-Line" - Design Make.
   b. Eaton Corporation "PRL3".
   c. General Electric by ABB ReliaGear "neXT".
   d. Siemens.

C. Branch Circuit Panelboards (480Y/277 volt, 208Y/120 volt):

1. Provide branch circuit panelboard as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal-magnetic, molded case circuit breakers as scheduled.
2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67.
3. Provisions for additional circuit breakers shall be such that field addition of connectors or mounting hardware will not be required to add circuit breakers to the panelboard. Bus connections shall be bolt-on.
4. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the rating shown on the Panelboard Schedule or on the plans. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. Reducing breaker ratings on the basis of series rating is not acceptable.
5. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be specified in UL Standard 50 cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. Each front shall include a door and have a flush, stainless steel, cylinder type lock with catch and spring-loaded door pull. All panelboard locks shall be keyed alike. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge, full-finished steel with rust inhibiting iron phosphate sealer and baked enamel finish. Minimum box width shall be 20 in. Provide door-in-door construction.
6. Panelboards with main circuit breaker shall have inherent and listed coordination of the main and branch circuit breakers.
7. Ratings shall be as indicted on the Panelboard Schedule.

8. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
    a. 480Y/277 Volt:
        1) Square D "NF" - Design Make.
        2) Eaton Corporation "PRL2".
        3) General Electric by ABB ReliaGear "RE" or "RS".
        4) Siemens.
    b. 208Y/120 Volt:
        1) Square D "NQ" - Design Make.
        2) Eaton Corporation "PRL1".
        3) General Electric by ABB ReliaGear "RQ".
        4) Siemens.

D. Circuit Breakers:
1. Circuit breakers below 400 amp frame shall be molded case with inverse time and instantaneous tripping functions, unless indicated otherwise in contract documents.
2. Circuit breakers 400 amp frame and above shall be 100% rated and equipped with front adjustable solid state trip units with short time, short time delay, long time, long time delay, and instantaneous trip functions as indicated.
3. Listed combination of coordinated circuit breakers shall be verified by the equipment manufacturer utilizing published data sheets. Confirm listings shall be submitted.
4. Lugs shall be mechanical, rated for 60/75° AL/Cu.
5. Branch circuit breakers shall be quick-make, quick-break, thermal-magnetic and trip indicating, and multipole breakers shall have common trip. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac or 277 V ac and carry the SWD marking.
6. Ground-Fault circuit breakers shall be quick-make, quick-break, thermal-magnetic, 5 milliampere ground fault sensing and trip indicating, and multipole breakers shall have common trip. The ground fault circuit breakers shall not occupy any more space than a standard breaker of the same number of poles.
7. Arc Flash Energy Mitigation:
    a. Provide the following arc flash energy mitigation system for all circuit breakers 1200A and larger.
    b. Arc Energy Reduction Maintenance Switch
        1) Equipment main circuit breaker shall have a selector switch in the front of the unit enclosure for maintenance periods. The switch shall be labeled "Normal" and "Maintenance".

The normal position shall utilize the standard trip settings of the breaker. The maintenance position shall utilize a quicker series of trip settings to reduce the potential arcing energy. The selector switch shall have a protective flip up cover. LED warning light on the face of the unit enclosure shall indicate when in the maintenance mode and have appropriate signage. The system shall be fully wired and tested by a factory authorized/trained technician.

8. Ratings shall be as indicated in the Contract Documents.

9. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:

   a. Square D Micrologic trip unit - Design Make.

   b. Eaton Corporation Optim 550 trip units for circuit breakers 400 - 1600 amp frame or RMS 610 trip units for 2000 amp frame to 6000 amp frame.

   c. General Electric Spectra RMS or MicroVersa trip unit.

   d. Siemens Sentron Sensitrip III trip unit.

10. Enclosed circuit breakers shall be molded case, thermal-magnetic type, ratings as noted, with overcenter, trip-free, toggle-type operating mechanism, quick make/quick break action and positive handle indication. Multiple pole breakers shall be common trip type. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pose. Provide provisions for padlocking in the "off" position. Breakers shall be calibrated for operation in an ambient temperature of 40°C and shall be suitable for mounting and operating in any position. Breakers shall have removable lugs, UL listed for copper and aluminum conductors. Breakers shall be installed in NEMA 1 general purpose, surface enclosures, unless otherwise noted.

    a. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

       1) Square D

       2) Cutler Hammer

       3) General Electric by ABB

       4) Siemens

E. Power Meter

1. Where indicated on the drawings, provide a factory installed unit mounted power meter with the following parameters:

   a. LCD or LED display.

   b. Line voltage control power.

   c. Voltage input with overcurrent protection and disconnecting means.

d. True RMS voltage and current measurement.

e. Metered parameters: Phase current, line voltage, phase voltage, frequency, power factor per phase and three phase total, real power per phase and total, reactive power per phase and total, apparent power per phase and total, total real energy, total reactive energy, total apparent energy, user configured sliding window for real, reactive and apparent power peak demand. Sampling rate shall be 512 sample points per cycle minimum. Waveform capture with adjustable triggers.

f. Accuracy: Energy, and demand power: 0.2% in accordance with ANSI C12.20Instrument current transformers shall be factory wired to shorting blocks to prevent open-circuiting the current transformers under energized conditions. The meter shall also be user programmable for current to any CT ratio.

g. Capable of metering up to 480 volts without external potential transformers. The meter shall also be user programmable for voltage range to any PT ratio.

h. Communications: Modbus RTU, TC/IP, etc.

i. Acceptable Manufacturers:

1) Equipment (Unit Manufacturer)

2) Square D

3) Eaton

4) Shark

F. Disconnect Switches:

1. Shall be heavy-duty type three-pole, with "Quick Make/Quick Break" operating handle mechanically interlocked with the cover, horsepower and voltage rated to match equipment served. Where indicated switches shall be provided with dual-element, time delay, rejection type fuses. Switches shall be installed in NEMA 1 for indoor use, NEMA 4 for outdoor use. Provide provisions for padlocking in the "off" position. Provide neutral bar in single phase or three phase, four wire circuits, and ground bar in all switches. Provide auxiliary contacts where called for. UL listed as suitable for use as service equipment where indicated on the drawings.

2. All disconnects connected downstream of ASD's shall have a normally open and normally closed auxiliary contacts which shall be wired to the ASD to indicate disconnect is open.

3. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

a. Square-D - Design Make.

b. Cutler Hammer.

c. General Electric.

d. Siemens.

G. Fuses:

1. All fuses rated 600 volts and below shall be rejection type dual-element, time-delay type. Provide two (2) complete sets of fuses for all fusible devices. Deliver spare fuses to the Owner and obtain receipt.

2. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

   a. Fuses 600 Amperes and Below: Bussman Type FRS-R (600 volts), Bussman Type FRN-R (300 volts) or equivalent.

   b. Fuses Rated Above 600 Amperes: Bussman Type KRP-C or equivalent.

H. Surge Protective Device:

1. Device shall be rated for location as shown on drawings.

2. Seven Mode Protection: Line-to-neutral (three), line-to-ground (three) and neutral-to-ground.

3. Provide test report from a recognized independent testing laboratory verifying the Surge Protective Devices (SPD) can survive published surge current rating on both a per mode and per phase basis. ANSI/UL 1449, latest edition.

4. Surge Current Capacity - The minimum total surge current tested with the ANSI/IEEE C42.41, 20 kA-8/20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

| | Application | Peak Surge Current Per Phase | Nominal Discharge Current - In Per Mode |
|---|---|---|---|
| a. | Type 2 - After Service Entrance | 160 kA | 20 kA |

5. Unit shall comply with ANSI/UL-1449, latest edition. Voltage Protection Rating (VPR) per Mode must not exceed the following for Type 2 SPD:

   a. 480Y/277, L-N 1000 volts, L-G 1200 volts, N-G 900 volts, L-L 1800 volts.

6. UL-1283 bi-directional high frequency noise attenuation for electric line noise shall be 50 dB at 10 kHz-100 MHz.

7. Short Circuit Current Rating: 200 KAIC.

8. Indication system:

   a. A green/red LED indicator for each phase.

   b. Flashing trouble light.

   c. Shall alarm open circuit damage, thermal conditions and overcurrent.

   d. Transient surge counter.

e. Provide dry contact for remote monitoring.

9. Integrated model.

10. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:

a. Cutler Hammer SPD.

b. L.E.A./Dynatech.

c. Liebert.

d. Square D - Design Make.

e. Current Technology.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. All equipment shall be grounded per the NEC.

B. Electrical distribution equipment shall have lugs/terminations suitable for the indicated conductor size. Where conductors have been oversized for voltage drop and where approved by the Engineer it shall be allowed to reduce the conductor size using hydraulically crimpled splice in a box next to the distribution equipment to allow for standard lug termination.

C. Install dry-type transformers with adequate clearances for proper ventilation. Bolt floor mounted transformer to pad.

D. Distribution switchboards, motor control centers and floor mounted dry-type transformers shall be mounted on 4 in. high concrete pads which shall extend 3 in. on all sides. Securely bolt the unit to the pads for proper horizontal and vertical alignment.

E. Coordinate transformer pad dimensions with transformer manufacturer's requirements. Coordinate transformer pad locations, dimensions and details with General Contractor.

F. Provide pad lockable branch circuit breaker device to hold circuit breaker in the closed position, but not prevent overcurrent protection, for all branch circuits serving fire alarm controls panels, emergency lighting and life safety branch circuits.

G. Identification:

1. Identify all items of equipment as described in Section 260501-3.1, Identification. Identification shall be provided for switchboards, panelboards, transformers, ASD's, motor starters, disconnect switches, enclosed circuit breakers, switchboard main/distribution breakers, MCC's automatic transfer switches, UPS's, generators, surge suppression devices, control panels, switchgear, etc.

2. Switchboards, panelboards, MCC's, switchgear, etc. shall have a label indicating name/tag ID, feeder source, conductor color convention and for service entrance locations the available short circuit current.

3.02 ELECTRICAL LOAD TEST

A. Conduct a load test prior to request for final payment and comply with the following:

1. Energize maximum normal light and power load for a period of two hours when scheduled.
2. Record voltage at service and at each panel.
3. Measure current in each phase of all feeders.
4. Adjust transformer taps as directed by engineer after review of report.
5. Provide and install all necessary metering equipment.
6. Owner's Representative or Site Representative shall witness the test.
7. Before final acceptance specified test shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such tests and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Protective equipment shall be actuated in a manner that clearly demonstrated their workability and operation.

3.03 CLEANING

A. At the completion of the project, while equipment is de-energized, it shall be thoroughly cleaned to a shipped condition using methods in accordance with the manufacturer's recommendations. Utilize vacuum for cleaning and not compressed gas.

3.04 SPARE PARTS

A. Deliver loose equipment to the Owner and obtain receipt for fuses, keys to panelboards, etc.

3.05 DISCONNECT DEVICES

A. All disconnect devices downstream of ASD's: Provide wiring, conduit and connections between ASD and disconnect auxiliary switch to ASD.

END OF SECTION

SECTION 26 27 13
ELECTRIC SERVICE

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment and services for the complete installation of an electric service and related Work required in these Contract Documents. The Utility Company is Consolidated Edison, Inc.

1.02 UTILITY COMPANY

A. Include all utility company fees and charges for service as part of contract.

1.03 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Standard factory inspection and operational tests will be acceptable.

B. Installation shall be accordance with utility requirements NFPA 70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA and IEEE Standards.

1.04 SUBMITTALS

A. All items of equipment and accessories including the following:

1. Underground ductbank materials.
2. Billing Instrument transformer enclosure.
3. Utility Company mast anchoring detail.
4. Equipment pad/vault.

B. Send three copies of submittals to the Utility Company for review before sending submittals to Engineers. Include one (1) Utility Company approved copy with submittal drawings for review.

1.05 SERVICE CHARACTERISTICS

A. Secondary Service:

1. Low Voltage: 480/277 grounded, wye, three phase, four wire, 60 Hz.
2. Source:
    a. Utility Company pad mount transformer, for underground service.
    b. Owner's switchgear installation.
    c. Owner's primary substation.

1.06 UTILIZATION VOLTAGES

A. Building power system shall be a nominal 480/277 volt, three phase, four wire, solidly grounded, 60 Hz system.

1.07 UTILITY COMPANY COORDINATION

A. Coordinate entire electric service with Utility Company.

B. Do not interrupt electric system until approved in writing, coordinated so outages occur at Project Site convenience.

C. Coordinate switching requirements with utility company, as approved in writing by the Owner.

1.08 DEMAND CONTROL SYSTEM INTERFACE

A. Coordinate with utility company, and provide all requirements for interfacing demand pulse signaling equipment on utility company kWH/demand metering instrument, and pay all fees and charges.

**PART 2 - PRODUCTS**

2.01 UNDERGROUND SERVICE DUCTBANK

A. Refer to Section 260501.

2.02 TRANSFORMER PAD

A. Refer to Drawings.

2.03 UTILITY COMPANY METERING ACCOMMODATION

A. Verify all requirements with Utility Company before proceeding.

B. Utility Company shall furnish all billing instrument CT and PT transformers.

C. Provide code gauge metal cabinet, as approved by Utility Company, to house billing instrument transformers.

D. Provide Meter Backboard:
    1. Use 3/4 in. x 5 ply marine grade plywood.
    2. Paint front and back of plywood with two (2) coats of exterior gray paint.

3. Size as required by utility company.

## PART 3 - EXECUTION

3.01 UTILITY COMPANY METERING ACCOMMODATION

A. Verify all installation requirements with utility company before proceeding.

B. Install meter backboard. Space board from wall when located on outside wall. Provide required clearances.

C. Mount CT cabinet where called for and as directed by the Utility Company.

D. Install instrument current and potential transformers in cabinet.

E. Provide 1-1/2 in. rigid galvanized steel conduit from the instrument transformer location to the meter backboard.

F. Install all test devices furnished by the Utility Company.

G. Utility Company shall provide all Utility Company metering instruments. Install all meter sockets as required.

H. Provide wiring from meter instrument to metering transformers as directed by Utility Company.

I. Provide grounding, connections and miscellaneous materials required.

3.02 INSTALLATION AT RISER POLE

A. Terminate at existing riser pole.

B. Stub conduit at position directed by Utility Company.

C. Provide hot dipped galvanized steel rigid conduit at riser.

D. Stub active conduit 10ft., and cap.

E. Stub spare conduit 1ft. above grade and cap waterproof with threaded cap.

F. Strap conduit to pole every 4 ft.

G. Place service lateral cable with cable length sufficient to extend 3 ft. above utility company secondary rack. Tape end of cable. Utility Company will form drip leg and make connections to lateral.

H. Ground as directed by Utility Company.

END OF SECTION

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SECTION 26 32 13
POWER GENERATION - GENERATOR, AUTOMATIC
TRANSFER SWITCH AND ACCESSORIES

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of generator, automatic transfer switch and related work required in these Contract Documents.

1.02 QUALITY ASSURANCE

A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be accordance with NFPA 37 (Installation and Use of Stationary Combustible Engines), NFPA 70 (National Electrical Code), NFPA 110 (Standard for Emergency and Standby Power Systems), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards. If skintight enclosure is used, the equipment shall be listed for UL 2200.

D. System emissions shall meet or exceed the EPA and Code of Federal Regulations 40CFR.

1.03 SUBMITTALS

A. Submit shop drawings only for manufacturers named. Submission of other manufacturers will be rejected unless the terms of equivalents and substitutions stated in the General Provisions are followed.

B. Submit shop drawings on equipment and accessories to include the following:

1. Engine-generator set, including engine, alternator, circuit protection, fuel consumption, exhaust flow/temperature, noise (dBA), performance ratings (kW, starting kVA, pf, voltage, etc.), thermal ratings, heat generation.

2. Engine controls, including starting controls, governor, etc.

3. Generator instrumentation, voltage regulator, insulation class, etc.
4. Catalog cuts, bill of materials, descriptive data, spare parts list for specified equipment.
5. Mounting arrangement, floor plans, elevations, overall dimensions including accessories, foundation, bedrail, and/or bolts, power and control conduit entrance space.
6. Weatherproof enclosure: dimensions, elevation, plan, attenuation, cooling, accessories, etc.
7. Batteries, mounting rack, accessories.
8. Gas regulator.
9. Automatic transfer switch and accessories.
10. Remote annunciator panel.
11. Wiring diagrams of all equipment, external and internal connections and interconnections.
12. Emergency shutdown switch.
13. Factory tests and field supervision reports as called for.

C. Composite Instruction Books shall include as a minimum the following:

1. Instructions covering overall equipment.
2. Instructions covering all major and serviceable components, and accessories.
3. Recommended spare parts with current prices.
4. Complete renewal parts information.
5. Quantities of oil/coolant/etc.
6. Instructions, both individually and collectively, shall adequately describe receipt, handling, care, inspection, installation, operation, and maintenance of equipment.
7. Instruction books shall be used for equipment installation, and submitted prior to project closeout.
8. Factory trained maintenance provider contact information.
9. System error code (alarms, faults, etc.) list with descriptions.

## 1.04 STANDARDS AND TESTS

A. Equipment covered by these specifications shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of all applicable published ANSI, NEMA, and IEEE Standards, the requirements of NEC, NFPA 37, NFPA 110, UL 1008 and UL 2200 Standards. State and local requirements.

B. Furnish submittals of field test reports covering field tests and inspections performed and conducted by manufacturer's representative.

1.05 FIELD SUPERVISION

A. Submittal shall state that adequate local **(**within 75-mile radius of project locations**)** field supervision and service, by competent qualified representative of the manufacturer, who is regularly engaged in working on this type of equipment, will be available at any time.

B. Submittal shall state address of nearest vendor's place of business, telephone number and name of person to contact for field service.

C. Provide field supervision/service at no additional cost to cover inspection, test, and start-up of this equipment.

D. Submittal shall state the amount of field supervision/service recommended by vendor to cover critical points of installation, inspection, test, and start-up.

E. Provide proposal for a yearly maintenance agreement for time beyond the warranty period.

F. The above data shall be included with submittals.

1.06 RIGGING

A. Provide rigging to unload, move, transport, set in place, erect, etc.

1.07 WARRANTY

A. Provide a warranty for the specified equipment to be free from defects in materials and workmanship, whether functional or nonfunctional, replace or repair without cost, defects which, with normal usage, appear within **one (1)** year of project closeout.

1.08 TRAINING

A. Provide verbal and written training to facility appointed personnel in the proper and safe manner of operating equipment.

B. Training shall be at a time convenient for the Owner, not during system start up/testing and be a minimum of 4 hours or as needed for the Owner personnel to understand the system operation and maintenance.

1.09 DESCRIPTION OF SYSTEM OPERATION

A. Provide Engine-Generator System to meet the following functions:

1. Arrange system for automatic starting upon failure of normal source voltage.
2. Provide programmable one-second time delay, field adjustable from 0 to 9999 seconds. Delay time between normal source failure and engine starting.
3. Initiate engine starting cycle from transfer switch auxiliary dry contact.

4. Transfer standby loads from normal source power to emergency source when engine-generator reaches 90% of its rated voltage.
5. Retransfer emergency loads from emergency generator to normal source ten (10) minutes after normal source has reached 90% or more of normal voltage. Control shall be field programmable from 0 to 9999 seconds.
6. Retransfer emergency loads from emergency generator to normal source instantaneously when normal source has reached 90% or more of normal voltage, if emergency generator has failed while supplying load.
7. Run engine for a period of ten (10) minutes after retransfer of emergency loads to normal source. Engine-generator will then shut down, automatically resetting and leaving all controls ready for the next emergency start condition. Period shall be programmable from 0 to 9999 seconds.
8. Use integral automatic transfer switch time clock to automatically exercise engine once each every four weeks for 30 minutes. Time clock contacts shall simulate loss of normal voltage; start engine, and shut engine down after fifteen minutes of operation. The load shall not transfer to the emergency source during the exercise time. Provide a selector switch to permit cycling engine-generator under load or no-load conditions.
9. Shall shutdown upon activation of remote emergency shutdown button.

## PART 2 - PRODUCTS

2.01 ENGINE-GENERATOR SET

A. General: The system shall meet the following parameters.
1. 480Y/277 volts, 12 lead, three phase, four wire, connected, 60 Hz.
2. 275 kW stand-by rating at 0.8 power factor.
3. Minimum motor starting kVA rating shall be 790, based on 30% instantaneous voltage dip.
4. Suitable for ambient conditions:
a. Ambient Temperature: -25C to 40°C.
b. Altitude: 1000ft above sea level.
5. Maximum of 180.65 in. L x 57.49 in. W x 107.3 in. H (with silencer).
6. Maximum allowable combustion exhaust back pressure of 20.4 in. WC.
7. Combustion exhaust temperature shall not exceed 1,000°F and 1,550 CFM.
8. System fuel consumption shall not exceed 18.5 GPH.

B. Engine - Diesel Fuel:
1. Diesel, to operate on #2 diesel fuel.
2. Minimum six (6) cylinder, four cycle, 1800 rpm. Forged steel crankshaft and connecting rods, cast iron, turbocharged and after cooled where

recommended by the generator set manufacturer. Gearing to achieve the 60 Hz is not acceptable.

3. Stand-by rating shall be adequate to provide maximum kW output of generator under full load and motor starting kVA requirements. The diesel engine generator set shall be capable of picking up 100% of nameplate kW, after adjusting for site conditions (altitude, temperature), in one step with the engine generator set at operating temperature, in accordance with NFPA 110. A resistive load bank (1.0 pf) shall be acceptable for meeting the load requirements.
4. Individual injector per cylinder with replaceable fuel filter element.
5. Engine-driven positive displacement fuel transfer pump. Fuel filter with replaceable element.
6. Full pressure lubrication system with positive displacement, mechanical, full pressure oil pump, full flow oil filter with replaceable filter element, equipped with spring-loaded bypass valve as an insurance against stoppage of lubricating oil in the event filter becomes clogged. Provide with water-cooled oil cooler.
7. One or more oil or dry type air cleaners of sufficient capacity to protect engine working parts from dust and dirt.
8. Water cooled with skid mounted, closed loop type radiator, belt or direct driven pusher fan, centrifugal water circulating pump, thermostat temperature control suitable for unit full load operation and 50°C ambient condition. Provide radiator with duct connection flange. Rotating parts shall be protected against accidental contact. Low coolant level sensor alarm and shutdown.
9. The cooling system shall be rated for full rated load operation in 50°C ambient conditions.
10. Provide 50/50 solution of propylene glycol for engine closed loop cooling system.
11. Provide thermostatically controlled water jacket heater suitable for the intended location for NFPA 110 and wiring, rated for 120-volt, single phase operation. Unit shall be sized to maintain unit temperature for optimum starting conditions. Provide circuit for this from a normal power source.
12. Electronic governor shall provide automatic engine-generator set frequency regulation adjustable from isochronous 0% droop. Governors using external throttle linkages are not acceptable.
13. Battery starting system per manufacturer's recommendation.
14. Engine mounted belt driven battery charging alternator, 35 ampere minimum, and solid-state voltage regulator. Battery charging time shall not exceed24 hour for a full recharge.
15. An electric starter capable of three complete cranking cycles without overheating, before overcrank shutdown. Shall comply with NFPA 110.

16. Provide (4) diamond shaped labels in accordance with NFPA 704, one installed on each side of the generator room or enclosure. Labels shall be suitable for exterior use. Label shall have an overall height of 14" and contain 3" tall numbers.

C. Generator/Alternator:

1. Synchronous, four pole, compatible with unit rpm, revolving field, fireproof construction. Brushless, permanent magnet exciter with solid state voltage regulator.
2. Insulation rating of alternator shall, at a minimum, meet requirements of NEMA Class H construction to comply with NEMA standard MG1-22.40 and 16.40. Temperature rise of rotor and stator shall be limited to Class F (155°C or 105°C maximum temperature rise of winding, measured by resistance method, at 40°C ambient) for standby rating.
3. Insulation rating of alternator shall, at a minimum, meet requirements of NEMA Class H 180°C construction to comply with NEMA standard MG1. Temperature rise of rotor and stator shall be limited to 150°C maximum temperature rise of winding, measured by resistance method, at 40°C ambient) for standby rating.
4. Voltage regulation within 0.5% plus or minus of rated voltage for any constant load from no load to full load.
5. Frequency regulation shall be isosynchronous from steady state no load to steady state rated load. Speed variations for constant loads from no load to rated load shall not exceed ±0.25% of rated speed, with constant ambient and operating temperature.
6. Provide plus or minus 5% voltage adjustment.
7. Total harmonic distortion (THD) shall not exceed 5% of rated voltage and no single harmonic shall exceed 3% of rated voltage.
8. Telephone influence Factor; TIF shall be less than 50 per NEMA MG1-22-43.
9. Terminal voltage re-established to within 2% of rated voltage within four seconds following any sudden change in load between no load and full load or between full load and no load.
10. Sealed, permanently lubricated ball bearings.
11. Direct or beltdriven generator cooling blower.
12. Provide fixed field connections to AC output leads in extra-large terminal box with removable cover.
13. Provide adequate wiring space for conduits. Power cables shall exit the bottom of the generator.
14. Exciter shall be brushless, permanent magnet type.

D. Generator Auxiliary Equipment:

1. Provide generator output circuit breaker(s) as indicated, three pole, common trip, shunt trip, thermal magnetic type, to completely protect the generator from overloads; frame size and trip rating as called for. Provide solid state trip unit and 100% rating for circuit breakers 250A and above with long time, short time and instantaneous adjustable settings.
2. Sub-Base Fuel Storage Tank: Provide a dual wall sub-base fuel storage tank with sufficient usable storage capacity to provide 24 hours of operation at 60 Hz full load rating. The tank shall be made of corrosion resistant steel. Internally baffled to prevent immediate re-supply of heated return fuel. Fuel level gauge. Electrical stub-up area with detachable end panel. Tank to foundation ground clearance for visual secondary leak detection. Weatherproof secondary containment. Constructed with minimum 8-gauge aluminized steel top, 12-gauge aluminized steel sides and bottom, with 4 in. minimum "C" channel side and bottom load bearing structure. Baked enamel custom finish to match generator housing. UL listed to UL 142. Provide with low/full fuel level alarm, leak detection alarm and 5 gallon over fill capture basin. Provide enough fuel of the type recommended by the equipment manufacturer to completely fill the tank.
3. Contractor shall supply all fuel as recommended by the manufacturer for testing and fill all fuel systems at their expense to the full level before final payment will be approved.
4. Outdoor weather-protective housing with exhaust muffler installed and located within the housing. The housing shall have hinged access doors for all maintenance and control locations. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. All hardware (hinges, screws, bolts, door operator, etc.) to be stainless steel. Input and output air dampers with controlled damper motorized actuators shall be spring open and held closed when not in use. Unit sound attenuation shall limit the noise level to 74 dB at 23 ft. Provide concrete pad as detail on the drawings. Generator unit shall be UL 2200 labeled with enclosure installed.
5. Battery Heater: Provide pad type battery heater suitable for intended location. Provide circuit for this from a normal power source.

E. Acceptable Manufactures:

1. Cummins, Inc.
2. Generac
3. Caterpillar (Design Make)
4. MTU/Detroit Diesel
5. Kohler

## 2.02 MICROPROCESSOR ENGINE-GENERATOR SET CONTROL

A. The control shall have automatic remote start capability. Starting cycle shall be initiated by auxiliary contact(s) in automatic transfer switch. A panel mounted switch shall stop the engine in the STOP position, start and run the engine in the RUN position, and allow the engine to start and run by closing a remote contact, and stop by opening the remote contact when in the REMOTE or AUTOMATIC position.

B. Automatic start circuit shall be supervised at the generator. Upon short, ground or other malfunction of the start circuit a trouble condition shall indicate at the generator controller and remote annunciator and the generator shall automatically start.

C. The control shall include a cycle cranking function. The cranking cycle, nonadjustable, shall consist of an automatic crank period of approximately 15 seconds duration followed by a rest period or approximately 15 seconds duration. Cranking shall cease upon engine starting and running. Two (2) means of cranking termination shall be provided, one as a backup to the other. Failure to start after three cranking cycles (75 seconds) shall shutdown and lockout the engine, and visually indicate an overcrank shutdown on the panel.

D. The control shall shut down and lock out the engine upon: failing to start after the specified time (over crank), overspeed, low lubricating oil pressure, high engine temperature, or operation of a remote manual stop station. Provide audible alarm and visual indication of the particular contact that operated, and reset pushbutton. Provide common fault contacts, wired to terminal board for remote alarm indication.

E. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.

F. The generator control system shall enable remote diagnostics and building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations.

G. Communications shall be supported with building automation through Modbus, Ethernet or Building Management System protocol without network cards.

H. Circuit boards shall be sealed/encapsulated and potted where beneficial for vibration and moisture.

I. Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture selectable operational parameters during events, simultaneous monitoring of all input or output parameters, and 0.2 msec data logging capabilities.

J. In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

K. The control system shall provide pre-wired a minimum of six owner customizable digital outputs and communications support with RS232, RS485, or an optional modem.

L. System inputs/outputs shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality.

M. The control panel shall be a NEMA 12 enclosure and include a digital display for all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

N. Upon overload of generator capabilities, controller shall protect the alternator by shutting down the generator and shunt trip the circuit breakers.

O. The control shall engine monitor indicator LEDs on the control panel; one red light for each of the five shut downs (except the remote manual stop), and one yellow light each for the high engine temperature and low engine oil pressure prealarms, and one green run light. The control panel monitor shall include; a flashing red light to indicate the generator set is not in automatic start mode, a yellow light to indicate low coolant temperature, a yellow light to indicate low fuel, a red light to indicated battery charger failure, and one red light for auxiliary use (for a total of twelve). A panel mounted switch shall reset the engine monitor and test the lamps. The engine-generator set starting battery(ies) shall power the monitor. Operation of shut down circuits shall be independent of indication and prealarm circuits. Provide a low coolant level shutdown, which shall be indicated as a high engine temperature fault.

P. Provide remote annunciator(s) in Room indicated for engine-generator alarm function. Alarm functions for generator shall comply with NFPA 110 and as a minimum are as follows:

1. Visual signals for: Battery charger AC supply failure, battery charger DC output failure, engine-generator running.
2. Visual and audible signals for: Overspeed, low lube oil pressure, high and low water temperature, overcranking (failure to start), overload, over speed, on temporary power, low fuel, low coolant level, generator supplying load, low battery voltage and charger failure.
3. Provide all of the indications and audible alarms called for above. Provide alarm silence and lamp test switches.

## 2.03 BATTERIES

A. Provide batteries as follows:

1. Sealed lead acid type, quantity and connections as recommended by the generator set manufacturer.
2. Provide corrosion-resistant battery mounting rack, battery interconnecting cables and terminals, etc.
3. Provide battery heating pad suitable for the intended location, 120 VAC and power connection to maintain 10 second starting time.

## 2.04 AUTOMATIC TRANSFER SWITCH (ATS)

A. Description:

1. The automatic transfer switch shall consist of a power transfer switch and a microprocessor based control module, interconnected to provide complete automatic operation. Double throw, mechanically and electrically interlocked. All main contacts shall be of silver composition. The operating transfer time shall be a maximum of 1/2 of a second. Transfer switch shall be capable of manual transfer in order to meet the requirements of UL 1008 and UL listing requirements as described UL's "Electrical Construction Materials." Circuit breakers shall not be used as a switching means.
2. Operated by momentary energization of a single coil with mechanical latching in both normal and emergency positions.
3. Operating voltage for transfer obtained from source to which load is to be transferred.
4. Three phase, four wire, three pole, solid neutral 120 volt normal and emergency power source contacts.
5. Ampere rating as called for, rated for continuous duty.
6. Unit shall be service entrance rated with a main circuit breaker.
7. Provide magnetic blowout coils and arc barriers on each pole.
8. Provide voltage supervisory relays on each phase of both normal and emergency sources, such that transfer and engine start is affected should any one phase of the three phase supply be below 80% of normal voltage.
9. Three-cycle closing and withstand rating minimum 35,000A rms symmetrical amperes without the use of current limiting fuses.
10. Manufacturer's standard mechanical type lugs suitable for aluminum or copper conductors. Provide lugs for each power cable, phase and neutral. Cable size and conductor type as called for. Terminals front connected.
11. Provide dual transfer switch operator with adjustable time delay 0-9999 seconds set at 3 seconds for a neutral position to allow motor loads residual voltage to decay between the time that the closed source is opened and the open source closed.

12. Provide pilot lights (LED's) as follows:
    a. Green, indicating normal switch position.
    b. Red, indicating emergency switch position.
    c. Fuse for each light.
13. Provide the following accessory features:
    a. Adjustable time delay before engine starting, field programmable from 0-9999 seconds. Factory set at 1s.
    b. Adjustable time delay on transfer to emergency, field programmable from 0-9999 seconds. Factory set at 3s.
    c. Adjustable time delay on retransfer to normal field programmable from 0-9999 seconds, factory set at 300 seconds.
    d. After retransfer to normal, the engine generator set shall be allowed to run, unloaded, for an additional 0-9999 seconds, factory set to 300 seconds.
    e. Test switch, engine start and transfer.
    f. Pushbutton to bypass time delay on retransfer back to "normal" position.
    g. Engine start contact.
    h. Time clock exerciser with transfer. Retransfer shall be automatic at end of exercise period. Provide a bypass switch for manual exercise and a selector switch to permit cycling engine-generator under load or no-load conditions.
    i. Auxiliary contacts to indicate normal, emergency and neutral position, two form C for each position. No common wires for auxiliary contacts. Bring wires to terminal block, suitably labeled.
    j. A contact which closes when normal source fails for initiating engine starting, rated min, 10A @ 32 VDC.
    k. A contact which closes when unit is on emergency power and normal power returns and is suitable for use. Contact shall be wired to elevator controller.
    l. Provide ground studs to enclosure for mechanical lugs for size #4/0 copper cables.
    m. Provide any other accessories as may be required to achieve operation as described in Article 1.9.
    n. Provide minimum of 12 of spare fuses.
    o. Provide NEMA 12 sheet metal enclosure for all mounting, front door hinged.
    p. All time delay relays shall be field programmable and shall show the actual setting time in minutes or seconds.

B. Acceptable Manufacturers:

1. ASCO (Design Make)

2. Russelectric RTB (single operator).

3. Cummins, Inc.

4. Zenith.

2.05 POWER METER

A. For each transfer switch provide a factory installed unit mounted power meter with the following parameters:

1. LCD or LED display.
2. Line voltage control power.
3. Voltage input with overcurrent protection and disconnecting means.
4. True RMS voltage and current measurement.
5. Metered parameters: Phase current, line voltage, phase voltage, frequency, power factor per phase and three phase total, real power per phase and total, reactive power per phase and total, apparent power per phase and total, total real energy, total reactive energy, total apparent energy, voltage/current harmonics (% THD), user configured sliding window for real, reactive and apparent power peak demand. Sampling rate shall be 512 sample points per cycle minimum. Waveform capture with adjustable triggers.
6. Accuracy: Energy, and demand power: 0.2% in accordance with ANSI C12.20. Instrument current transformers shall be factory wired to shorting blocks to prevent open-circuiting the current transformers under energized conditions. The meter shall also be user programmable for current to any CT ratio.
7. Capable of metering up to 480 volts without external potential transformers. The meter shall also be user programmable for voltage range to any PT ratio.
8. Communications: Modbus RTU, TC/IP, etc.
9. Acceptable Manufacturers:
   a. Equipment (Unit Manufacturer)
   b. Square D
   c. Eaton
   d. Shark

2.06 EMERGENCY OFF PUSH BUTTON

A. System shall have a maintained contact mushroom head push button with lockable protective hinged cover. Unit shall be a two pole double throw unit in a

weather proof box/cover. Contacts shall be rated for 20A. Provide circuiting in conduit from the push button to the generator.

B. Push button shall shut down the generator operation until reset.

C. Locate the push button mounted on the exterior of the building for exterior generators and outside the generator room for interior generators.

## PART 3 - EXECUTION

### 3.01 INSTALLATION - GENERAL

A. General Requirements:

1. Completely coordinate installation, assure that elements of the system are compatible, operational and correct.
2. Provide rigging to unload, move, and set/bolt in place engine-generator and ATS. Provide concrete pad as detailed on the drawings.
3. Provide miscellaneous bolts, washers, nuts, clips, lockwashers, small hardware, etc., of durium or equal rust resistant material, to make installation complete.
4. Refer to "Grounding" section of specifications.
5. Install equipment plumb, level, and true.
6. Leave maximum space available in front, alongside, etc., all items of equipment, to allow easy access and servicing of serviceable components. Meet NEC requirements.
7. All floor mounted equipment shall have a 4" equipment pad with wire mesh reinforcement and doweled into the floor unless otherwise indicated.
8. Exterior units shall be a minimum of 5' away from the building or structure.

### 3.02 WIRING

A. Install power and control wiring between engine-generator set, transfer switch, battery charger, louvers, dampers, controls, coolers, batteries, day tank and all other various and related equipment.

B. Comply with Manufacturer's Instruction Books.

C. Color code and identify control and power wires and cables as called for.

D. Provide copper, 600-volt insulation minimum, control wiring; do not splice.

E. Generator start circuit shall be 2 hour rated type CI cable in conduit. This circuit shall be supervised and provide an alarm at the generator controller, remote annunciator panel and all other monitoring locations. Where there are multiple automatic transfer switches the start circuit shall homerun from each individual switch to the generator.

F. Provide "crimp-on" type terminal for control wire terminations, as called for.

G. Provide liquid-tight jacketed flexible conduit for all connections to engine, generator, and to day tank. All connections shall account for the anticipated vibration.

H. Provide green insulated grounding conductor in each conduit run.

3.03 PHASE IDENTIFICATION AND TESTING

A. Individual phase conductors shall be color coded as indicated in Section 260501 and the normal and emergency systems shall match.

B. Conductor phase shall be verified prior to applying/installing phase color indication.

C. Prior to operational testing of the system test phase rotation to ensure normal and emergency systems rotate in the same direction. This test shall be performed at each transfer switch. Provide a test report as part of the overall system testing report to indicate the following:

1. Date of test.
2. Personnel performing the testing.
3. For each transfer switch indicate switch designation, phase orientation (A, B, C) and rotation (clockwise, counterclockwise).

3.04 ENGINE - GENERATOR INSTALLATION

A. Install where indicated. Refer to drawings for installation detains, pad details, etc.

B. Provide necessary anchor bolts at proper locations, place by templates if required, for proper setting of engine-generator.

C. Manufacturer's Representative shall provide lube oil and anti-freeze for initial start-up. Electrical Contractor shall provide all fuel for start-up and testing and leave tank at the full level upon completion.

D. Entire system shall be complete and operational and shall be test operated, including simulated loss of normal power, all control devices shall be operated to test their function.

E. Determine exact requirements, verify locations, and comply with applicable regulations in installing equipment.

F. Provide an emergency off push button outside the generator room for interior locations or on the unit enclosure for exterior units.

G. Provide the services of the manufacturer's representative to check out the system and instruct the Owner in the operation of the system. Furnish written statement to the Owner's Representative that the checkout and instruction service has been

provided. Include statement that system operates properly, as called for. Submit statement as a submittal for review.

3.05 IDENTIFICATION

A. For installations that have a single grounding location (connected to the main service entrance) provide signage indicating the following: "WARNING - SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE OR BONDING JUMPER IN THE EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE(S) IS ENERGIZED."

3.06 ELECTRICAL LOAD TEST

A. Conduct a resistive load bank test to the full capacity of the generator for four hours after completion of installation, but before connecting to the building system. Record system voltage, current, kW, pf, oil pressure and temperature every 15 minutes with the manufacturer recommended values in the test report. Upon successful completion of load bank test, complete connections to building system and perform an operational test as outlined in "B" below.

B. Conduct a full operational test of complete system prior to request for final payment and comply with the following:

1. Start the generator by simulating a loss of utility power at each transfer switch.
2. Energize maximum emergency light and power load for a period of one hour when schedule.
3. Record voltage at generator and at each panel, using the same digital meter at each location.
4. Measure current in each phase of all feeders, using the same digital meter at each location.
5. Record the time from power loss to engine start and power transfer for each transfer unit.
6. Reconnect circuits in an effort to provide balanced (within 10%) load on all feeders.
7. Provide and install all necessary metering equipment.
8. During the load test verify and label equipment connected to the emergency system is as indicated on the drawings. Labeling shall be a yellow 2"x6" adhesive sticker indicating the type of load - Life Safety, Optional Standby, Critical Branch or Equipment.
9. Owner's Representative shall witness the test.
10. Provide complete test report with the following as a minimum:
    a. Attendees
    b. Time/date
    c. Initial parameters

d. Time delay on start.

e. Cranking time until the generator starts.

f. Time to reach rated frequency and voltage.

g. Time for each automatic transfer switch to switch to emergency.

h. Engine/generator parameters - oil pressure, temperature, voltage, current, kW, power factor, etc. for each 5 minutes.

i. Automatic transfer switch retransfer time.

j. Generator shut down time.

k. Owner sign off.

11. Before final acceptance, specified tests shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such test and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Notify Engineer when load bank test is scheduled two (2) weeks prior to actual test.

3.07 EQUIPMENT PROTECTION

A. Provide repair or replacement for all damage and defacement, whether functional or nonfunctional, to all equipment from the time it is unloaded, during installation, and during period of beneficial use, and until installation is accepted.

END OF SECTION

SECTION 265000
LIGHTING

## 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 DESCRIPTION

A. Provide interior and exterior lighting systems, including luminaires, hangers, supports, fittings, lamps, wiring, connections and controls, as indicated in the Contract Documents for complete and operational systems. Luminaires, in general, have been specified for the particular type of ceiling in which they are to be installed. Verify the ceiling construction details and provide luminaires suitable for the respective ceiling types and room finish schedule.

1.03 REFERENCES

A. The following standards, criteria, codes, etc. shall be followed in the manufacture and installation of the lighting systems.

1. NFPA
2. NEC
3. IESNA
4. NEMA
5. ANSI
6. UL

1.04 QUALITY ASSURANCE

A. Luminaires shall be as specified in the "Luminaire Schedule". Luminaire types, appearance, characteristics, photometrics, finishes, etc., correspond to the specified manufacturer and associated series or catalog number listed in the "Luminaire Schedule". Products of other listed acceptable manufacturers shall be equivalent in every way to that of the luminaire specified. The Engineer reserves the right to disapprove any luminaire type submitted which they feel is not equal in quality, appearance or performance to the luminaire specified.

B. Manufacturer's luminaire series or catalog numbers listed in the "Luminaire Schedule" indicate quality, type, and style, but may not cover required special design details. Provide luminaires having such special details as noted in the "Luminaire Schedule", as indicated by the specified luminaire model number and as required for proper installation.

C. All luminaires shall be new and bear a Nationally Recognized Testing Laboratories (NRTL) label for the service intended.

D. Luminaires shall be products of manufacturers regularly engaged in the manufacture of the type of luminaires specified and shall be the manufacturer's latest standard design that complies with specification requirements.

E. Verify the availability of all luminaires proposed to be used in the execution of the work prior to submitting same for approval. The discontinuance of production of any luminaire after such approval has been granted shall not relieve the Contractor from furnishing an approved luminaire of comparable quality and design at no additional cost.

F. Photometric and operational data shall be provided only by qualified and certified organizations. Certification documentation shall be submitted with the luminaire information.

G. Should there be any difference between drawings and schedules, secure from Architect/Engineer such information as necessary prior to providing proposal. When finishes are not definitely specified, they shall be as selected by the Architect and not be limited to standard finishes.

H. Locations indicated for luminaires are approximate. Field coordinate exact locations as near as possible to the location indicated. Coordinate with the Engineer for any major location changes.

1.05 SUBMITTALS

A. Product Data: For each luminaire type, include in a single submittal, in order of luminaire designation, the catalog "cut" sheet with complete manufacturer and model number. Product data should include the following:

1. Manufacturer and Catalog Number.
2. Features, accessories, materials and finishes.
3. Physical description and dimensions of luminaires.
4. Life, power input, output (lumens, distribution, CCT, and CRI) and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests (space to mounting height ratio, coefficient of utilization complete values, IES distribution, candlepower distribution by angle and luminaire efficiency). Format shall be in accordance with IES TM-27.
6. Power, signal, and control wiring diagrams between luminaires and controllers.
7. Lens/Louver Type.
8. Driver/ballast with each type luminaire as applicable (type, sound rating, overload protection, voltage, input/fixture wattage, ballast factor, power factor, etc.).
9. Emergency lighting units, including batteries and chargers.

10. Certification of IES LM-79, IES LM-80 and TM-21 testing for LED luminaires. Luminaires shall be tested in accordance with IES LM and TM standards.

11. Warranty.

B. Coordination Drawings: Provide coordination drawings in accordance with Section 260500. Reflected ceiling plan(s) 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. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structure members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including other luminaires, air outlets and inlets, speakers, sprinklers, access panels, ceiling mounted projectors, etc.

C. Color Chips: Provide color chips of available finishes for luminaires upon request of Architect/Engineer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Luminaires and equipment shall be delivered with NRTL and manufacturer's labels intact and legible. Broken, cracked and damaged materials and equipment shall be removed from the site immediately and be replaced with new materials and equipment. Luminaires and accessories shall be stored in protected dry locations in their original unbroken package or container. Luminaires shall be protected from dust and dampness both before and after installation. Luminaires shall be protected from paint and cleaning solvents during all phases of construction.

## PART 2 - PRODUCTS

2.01 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 hazard by a NRTL.

C. UL Compliance: Comply with UL 1598 and UL 8750.

D. Recessed Luminaires: Comply with NEMA LE 4.

## 2.02 LIGHT-EMITTING DIODE (LED) LUMINAIRES

A. Luminaires shall be identical in construction features, options and appearance to the luminaries specified in the Luminaire Schedule. LED luminaires include white and RGBW systems as indicated on the luminaire schedule.

B. Luminaires shall be provided with all cables, controllers, power supplies, drivers, connectors, terminators and accessories required for a complete installation. LED system shall utilize pulse width modulation, non-linear scaling techniques and reverse polarity protection.

C. Provide dimming down to 10% as a minimum, or to percentage indicated or called for on the drawings. Unless otherwise indicated, the dimming control shall be a 0-10VDC signal

D. RGBW LED systems where indicated shall be capable of at least 8-bit control of red, green, blue and white module. RGBW LED system shall be capable of setting each module with a unique and individual address. Each address shall be controlled independently by DMX or alternate method protocol. All RGB LED fixtures shall undergo a minimum of eight-hour burn-in testing during manufacturing.

E. LED luminaires shall be high brightness and binned for forward voltage, luminous flux and wavelength.

F. LED luminaires shall be tested in accordance with IESNA LM-79 (luminous output, power input, luminaire efficacy (lumens/watt), color temperature and color rendering index), IESNA LM-80 (L70, output luminous maintenance, 10,000 hour minimum test, calculation method is not acceptable) and IESNA TM-21/28. Luminaire output shall be a minimum of 100 lumens/watt. Rated life shall be a minimum of 50,000 hours at 70% output. Testing shall be performed by a US Department of Energy (DOE) accredited laboratory.

G. Drivers shall be solid state Class 1 power supply/driver with universal input (120-277V). The system shall have a minimum 90% power factor, 3.5 maximum crest factor, minimum efficiency of 90%, a maximum of 20% THD and overload protection. Adequate heat sink capability shall be provided to ensure the rated life. Unit shall meet FCC rules and regulations.

H. Where indicated luminaires shall have color tuning capability and control. System to have separate dimming (5-100%) and color (3000K to 5000K, or as indicated on drawings) adjustability. Control shall be Dali or DMX512 for controllability as indicated. The system shall utilize the most recent settings when energized.

I. The luminaire (to include LED sources and drivers) shall have a full five (5) year minimum warranty for replacement and labor.

1. Acceptable LED Node Manufacturers:

a. Philips
b. Osram
c. Cree
d. Nichea
e. Lumiled

J. LED Emergency Drivers:

1. LED emergency drivers shall have the following minimum requirements:

a. Operate indicated fixtures at full illumination for 90 minutes minimum.

b. Universal voltage input (120 to 277V).

c. Upon loss of normal power, fixtures shall automatically switch to battery power.

d. Upon restoration of normal power, fixture shall return to normal mode and charge battery.

e. Battery shall be maintenance free, nickel cadmium type with a minimum life expectancy of seven (7) years.

f. Driver shall be suitable for the environment installed.

g. Driver shall be Class 2 and enclosed entirely in the fixture (except for down lights and exterior locations).

h. Units shall be listed for UL924 -Emergency Lighting and Power Equipment.

i. Minimum five (5) year non-prorated full warranty.

j. Factory installed.

k. Shall include an emergency system test switch [remotely mounted in outlet box] [above ceiling adjacent to fixture] [integral to fixture.

l. Unit shall be self-testing and provide indication of unit failure.

m. Design Make: Iota, ILB-CP series or approved equal.

2.03 LUMINAIRE CONSTRUCTION

A. Metal Parts:

1. Free of burrs and sharp corners and edges.

2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Lenses:

1. Shall be listed materials tested in accordance with ASTM D-635, "Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position" and burns less than 2/5 inches per minute.
2. The products shall have a smoke density of less than 75 when tested in accordance with ASTM D-2843, standard test method for "Density of Smoke from the Burning or Decomposition of Plastics".
3. The flame spread rating shall not exceed 0-25 and smoke developed rating shall not exceed 450 in accordance with ASTM E-84, standard test method for "Surface Burning Characteristics of Building Materials".
4. Self-ignition shall not occur below 600°F, in accordance with ASTM D-1929, standard test method for "Ignition Properties of Plastics".
5. Materials shall remain in place 15 minutes at 175°F and fall from frame at 200° below ignition temperature in accordance with ASTM D-648, "Deflection Temperature of Plastics Under Flexural Load".

2.04 LUMINAIRE SCHEDULE

A. Luminaire schedule is found on the contract drawings.

**PART 3 - EXECUTION**

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION

A. Comply with NECA 1.

B. All luminaires shall be installed as per manufacturer furnished installation instructions.

C. Provide for every luminaire as shown on the plans, or as scheduled on the drawings.

D. Location of all ceiling and wall mounted luminaires shall be as indicated on the Architectural and Electrical drawings. The contractor shall verify ceiling type, construction, and material prior to ordering.

E. Provide luminaires with an IC rating for luminaires installed in direct contact with insulation.

F. Provide plaster frames for plaster ceilings and flanged frames for drywall ceilings.

G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

H. Luminaires shall be suitable and as recommended by the manufacturer for the actual intended mounting method and materials.

I. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

J. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

K. Wall-Mounted Luminaires:

1. Attached to structural members in walls, to a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.
2. Do not attach luminaires directly to gypsum board.

L. Suspended Luminaires:

1. Pendant and Rods:
   a. Pendant mount luminaires from 1/4 in. threaded rods of required length.
   b. Brace pendants and rods longer than 48 inches to limit swinging.
2. Aircraft Cable:
   a. Cables shall be 1/16 in. aircraft cable with end safety fittings. Cable shall be provided with 2 in. diameter mini-canopy and threaded coupler for attachment to a 1/4 in.-20 threaded stud extending 3/4 in. below ceiling.
   b. Cable assembly shall include a spring-loaded adjustment device mounted in the fixture.
   c. The Contractor shall be responsible for providing required supports for cable attachment.

d. For cord feed to the luminaire provide continuous cord clip of matching color to attach the cord to the cable.

e. Support per manufacturer's recommendations.

3. Support stem mounted, single unit luminaires with approved outlet box and accessories that hold tem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

4. Use tubing or stem for wiring at one point of continuous rows of luminaires and tubing, rod, or wire support for suspension for each unit of length of luminaire chassis, including one at each end.

M. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.

2. Use approved devices and support components to connect luminaire to building structure in a minimum of four locations, spaced near corners of luminaire. Utilize #10 steel wire; similar to that used to support the ceiling grid.

3. Provide UL listed seismic hold-down clips and fasten to luminaires and to ceiling grid members at or near each luminaire corner.

4. Install luminaires of sizes less than ceiling grid as indicated on reflected ceiling plans or center in acoustical panel and support luminaire independently with at least two metal channels spanning and secured to ceiling tees.

N. In-Grade Luminaires:

1. Provide a minimum of 6 in. peat gravel at the bottom of luminaire to allow for drainage. When installed in a concrete walkway, secure luminaire to rebar to prevent luminaire from "floating" when concrete is poured.

2. Seal conduit entry into luminaire to prevent moisture penetration into luminaire from conduit system.

3. Secure faceplate of in-grade luminaires in accordance with manufacturer directions to compress gasket evenly to form a waterproof seal. The use of power tools to secure faceplate is not permitted.

O. Provide all necessary accessories for "end-to-end" mounting where continuous rows of luminaires are indicated. All luminaire assemblies shall be grounded.

P. Luminaires installed in continuous rows may be fed by a single outlet if luminaires are UL approved and suitable for through wiring in luminaire raceway.

Q. New luminaires may be provided to replace existing luminaires indicated to remain or be reused, subject to shop drawing approval.

3.03 REMOTE BALLASTS/DRIVERS

A. Remote ballasts shall be mounted in an approved NEMA 1 enclosure. Remote ballasts shall be located in areas easily accessible to maintenance personnel.

B. Wiring from luminaire to remote ballast shall not exceed the ballast manufacturer's recommendations for distance.

**C.** Remote ballast shall be clearly labeled indicating fixture served, voltage, panelboard and circuit number served from.

3.04 GROUNDING

A. Ground all non-current carrying parts of all lighting luminaires.

B. All grounding shall be accomplished with NRTL tested grounding connectors suitable for this purpose.

3.05 LABELING

A. Attach a self-adhesive red dot label, 1/2 in. in diameter, to all luminaires with an integral battery backup and/or those tied into an emergency generator. Labels shall be attached to these fixtures or to adjacent ceiling tiles so that they are readily discernible for testing and maintenance purposes.

3.06 FINAL CLEANING

A. Immediately prior to acceptance, damp clean diffusers, glassware, luminaire trim, reflectors, lamps, louvers, lens and similar objects of all luminaires. Remove all dirt, corrosion, foreign material, finger marks, and blemishes. Replace all burned out lamps and failed components.

3.07 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 of Emergency Lighting: Under supervision of Engineer, 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.

D. Replace luminaires damaged during shipment, construction, or installation.

3.08 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260936 "Lighting Controls."

3.09 ADJUSTING

A. Provide adjusting the direction of aim of luminaires to suit occupied conditions. Adjustment may be required during hours of darkness.

B. Final distribution shall be acceptable to the Owner and may take several attempts.

END OF SECTION

SECTION 26 55 00
LIGHTING CONTROL

## PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide a complete lighting control system as indicated on the Contract Documents and as specified herein.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 QUALITY ASSURANCE

A. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers.

B. Installation shall be accordance with NFPA 70 (National Electrical Code), energy conservation codes, state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA and IEEE Standards.

D. All equipment shall NRTL tested.

E. All components and assemblies are to be factory pretested.

F. The controls provider must:

1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.
2. Demonstrate that they have successfully installed similar systems, utilizing their standard products, for a minimum period of five (5) years.
3. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.
4. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, must provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.

1.04 SUBMITTALS

A. Submit the following equipment, materials, and products including all components and accessories:

1. General Equipment
2. Vacancy/occupancy Sensors

B. Submit the shop drawings and the product data specified below at the same time as a single submittal package.

C. Product Data: Provide equipment data sheets, specifications, wiring diagrams and installation instructions for all required system components.

D. Shop drawings shall include the following at a minimum:

1. Composite custom wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted). Wiring diagrams shall include all system components, including but not limited to: room controllers, digital switches, vacancy/occupancy sensors, photocells, isolated relays, digital I/O interfaces to conference room A/V systems, network interfaces, lighting control panels and associated components.
2. All system devices shall be located per the system manufacturers recommendations. All devices shall be suitable for the building configuration and intended operation.

1.05 SYSTEM DESCRIPTION

A. The lighting control system and/or components, as specified and indicated on the drawings to provide the intended and required control of the lighting systems.

**PART 2 - PRODUCTS**

2.01 GENERAL EQUIPMENT

A. Switches

1. Toggle/Snap

a. Unit shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, side/back wired, with nylon/polycarbonate toggle, self-grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20.

b. Acceptable Manufacturers (for single pole units, provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model).

1) Hubbell HBL1221

2) P&S 20AC1

3) Leviton 1221-2

2. Low Voltage

a. Unit shall be button type switch that is configurable from one button to eight buttons using point-to-point low voltage wiring for control of single or multiple loads. Each button shall provide a momentary contact and all share a common return. The switch shall be totally passive and contain no active electronics or power supply. Operation is dependent upon a Class 2 connection to a compatible relay panel or other device that can react to a momentary contact signal.

b. Each button shall have an LED indicator light that can serve as a status indicator or as a locator light. The LED indicators shall be powered by a 24VDC source originating from the lighting control panel or other device. The button quantities shall be as indicated on the plan views.

c. Acceptable Manufacturer

1) Wattstopper LVSW series (Design Make)

2) Acuity Brands

3) Hubbell

4) Approved Equal.

3. All device colors shall match the surrounding devices and shall be selected by the Architect**.**

B. Lighting Dimmers

1. Provide lighting dimmer where indicated suitable for the type of luminaire for even continuous control. Unit shall be rated for the indicated connected load plus 25% minimum (even when ganged). Review luminaire schedule and plans for type and loading. Provide for three-way control as indicated.

2. Low voltage dimming shall be as recommended by the luminaire manufacturer for magnetic or solid state.

3. LED dimmers shall be as recommended by the luminaire manufacturer and be listed for use with the associated driver.

4. Device color shall match the other project devices.

5. Acceptable Manufacturers:

a. Lutron (Design Make)

b. Crestron

c. Acuity Brands

d. Leviton

e. Approved equal

C. Time Switches:

1. Electromechanical Controllers:
   a. DPST, 40A per pole: NSI-Tork 120V - 7002Z, 277V - 7202Z
   b. 3PST, 40A per pole at 277 volt: NSI-Tork 7302Z.
   c. Two-circuit lighting control center: NSI-Tork T-920L.
   d. Three-circuit lighting control center: NSI-Tork T-903-L.
2. Time switches shall be provided with NEMA 1 general purpose, surface mount enclosures unless otherwise noted.

D. Photoelectric Controls:

1. Heavy Duty, 1/2 in. Conduit Mounting:
   a. 120 volt, SPST, 2000 watt: Tork Model 2101.
   b. 277 volt, SPST, 2000 watt: Tork Model 2104.
2. Combination Photoelectric Control and Contactor:
   a. 120 volt, DPST, 3000 watt per pole: Tork Model 5403.
   b. 277 volt, DPST, 3000 watt per pole: Tork Model 5404-3.
   c. 208 volt, DPST, 3000 watt per pole: Tork Model 5404.

E. Lighting Contactors

1. Similar to magnetic motor starters without overloads. Refer to specification 262000.
2. Mechanically held, electrically operated with control as indicated.
3. NEMA 1 enclosure.
4. Supply with appropriate accessories to interface with 2-wire and 3-wire control devices as required by the Construction Documents.
5. 10,000 ampere withstand at 480V.
6. 30 ampere continuous current rating per pole at 600VAC.
7. Number of poles as indicated.
8. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
   a. ASCO 918 Series.
   b. Square D Class 8902
   c. Eaton
   d. GE

2.02 VACANCY/OCCUPANCY SENSORS

A. Vacancy/occupancy Sensors:

1. Vacancy/occupancy sensors shall comply with the following as a minimum:

a. Zero crossing switching operation (switch on/off only where sine wave is at zero volts) suitable for linear, non-linear and electronic/magnetic fluorescent ballasts for the loads indicated. Where the load to be controlled exceeds the sensor load rating provide a separate relay of adequate rating.

b. Failure of the unit shall be to the on/closed position or manual operation.

c. Motion sensitivity adjustment (dip switch or dial) and time delay adjustment (5 to 30 minutes minimum, dip switch or dial).

d. Line voltage input and switching. Field selectable for 120 or 277 VAC, 60 Hz.

e. UL listed and have a five (5) year manufacturer full replacement warranty.

f. Test mode feature to override the set time delay to allow adjusting of the sensitivity.

g. Sensor locations shall be adjusted during construction and at occupancy as recommended by the manufacturer for optimal sensing and operation.

h. Operation shall be field selectable with vacancy sensor being manual "on" with close switch/contact upon motion sensing and open after the set amount of time delay without motion or occupancy sensor being automatic on upon motion sensing.

i. Adjustable controls/settings shall only be accessible when the front cover is removed or from the back of the unit.

j. Unit color shall match the project devices except for the ceiling-mounted units which shall match the ceiling color. All color selections shall be by the Architect.

k. Ultrasonic sensing shall not be affected by air movement and shall operate at 32 kHz minimum (shall not interfere with hearing aids or other equipment).

l. Provide components as needed for the indicated control.

m. A factory-authorized representative shall coordinate and instruct the startup services of the sensors providing placement recommendations, connection guidance and startup supervision and adjustment.

2. Wall Mounted - Dual Technology:

a. Unit shall fit into a standard single gang electrical box, have an On/Off button, and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one (1) is needed to keep it closed.

b. Minimum Switching Capacity: 120 V - 800 W, 277 V - 1200 W.

c. The sensing shall be 180 degrees and the sensitivity area to be a minimum of:

1) Major Motion (Walking/Arm Wave): 35 ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.

d. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

e. High impact resistant sensor lens.

f. Acceptable Manufacturers:

1) Wattstopper DW-100 (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

3. Wall Mounted - Dual Technology - Dual Switching:

a. Unit shall fit into a standard single gang electrical box, have two (2) On/Off buttons, and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one (1) is needed to keep it closed. To have two (2) contacts each fully rated, electrically separate and be commonly controlled.

b. Minimum Switching Capacity: 120 V - 800 W, 277 V - 1200 W.

c. The sensing shall be 180 degrees and the sensitivity area to be a minimum of:

1) Major Motion (Walking/Arm Wave): 35 ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.

d. Ambient light level sensing (adjustable 20-300fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

e. High impact resistant sensor lens.

f. Acceptable Manufacturers:

1) Wattstopper DW-200 (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

4. Wall Mounted - Dual Technology - Dimmer Switch:

a. Unit shall fit into a standard single gang electrical box, have an on/off button and utilize dual technology (PIR and Ultrasonic) motion sensing. Both types of sensing are needed for contact closure, but only one is needed to keep it closed. Selectable

manual or automatic on mode. Provide with 0-10 VDC dimming control with raise and lower buttons.

b. Minimum Switching Capacity: 120 V - 1000 W, 277 V - 1200 W.

c. The sensing shall be 180° and the sensitivity area to be a minimum of:

1) Major Motion (Walking/Arm Wave): 35ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.

d. Ambient light level sensing (adjustable 20-300 fc) to prevent "on" operation when the ambient light level is greater than the set point level.

e. High impact resistant sensor lens.

f. Dimming Control Signal: 0-10 VDC, with minimum sink current of 50mA. Raise/lower buttons to allow manual dimming of the space luminaires.

g. Acceptable Manufacturers:

1) Wattstopper DW-311 (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

5. Ceiling Mounted - Dual Technology (No Subscript):

a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one (1) is needed to keep it closed.

b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.

c. Sensing shall be 360 degrees with a minimum operating area of:

1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.

d. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.

e. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.

f. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

g. The maximum depth shall be 1.5 in. below the ceiling/box.

h. Acceptable Manufacturers:

1) Wattstopper DT-300 (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

B. Switch Pack:

a. Provide a minimum of one (1) switch pack for each ceiling-mounted vacancy/occupancy sensor. Provide additional units for multiple circuits (quantity to match the quantity of circuits).

b. Unit shall be plenum rated with line voltage side into a metallic box.

c. Low voltage power shall be suitable for a minimum of three (3) sensors. Multiple sensors shall be able to control a single switch pack.

d. Minimum switching capacity shall be 20A (all types of loads) at 120/277 VAC.

## PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide all required system components, interconnection wiring and branch circuit power connections as required by the lighting control system manufacturer to meet the intended sequence of operation and system performance requirements. All system wiring shall be in accordance with the system manufacturer's requirements at a minimum.

B. When using wire for connections other than the digital lighting control network (Category 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements. All Category 5e cabling and connectors shall be terminated and tested to meet the system manufacturer’s requirements. Category 5e cabling shall have a green thermoplastic jacket to easily identify from other building network cabling, building management system, or other low voltage systems cabling.

C. All line voltage wiring shall be installed in conduit. Terminations shall be done above accessible ceilings or within utility rooms and within a 4"x4" back box and have a suitable cover provided. Digital network devices (room controllers, isolated relays, plug load controllers, etc.) shall be mounted to a junction box and connected as recommended by the system manufacturer.

D. All low voltage control cabling shall be plenum rated. Cabling shall be installed in minimum 3/4" conduit in vertical runs in walls/partitions and inside mechanical/utility rooms. Provide suitable back box as required by the system manufacturer for the device being installed. Above accessible ceilings all control

cabling shall be installed within separate J-hook supports located at 3' on center with the cabling neatly bundled. All cabling inside utility rooms without ceilings shall be installed in conduit.

3.02 SYSTEM PROGRAMMING

A. Upon completion of the installation, the system shall be programmed by the manufacturer's factory authorized representative who shall verify a complete fully functional system.

B. The system manufacturer shall include separate individual site visits scheduled to complete the system programming and perform the following functions:

1. Initial system startup/programming (time shall be suitable to setup all system devices). A minimum of two days shall be accounted for the system initial setup.
2. Coordination with the owner to develop preferred lighting control scenes, scene illumination levels, button operation and coordinate day lighting requirements prior to final system programming. Once verified with the owner all system components shall be fully programmed and setup.
3. Verification of the system operation (time shall be suitable to test and verify day lighting functions are operating properly). The manufacturer shall provide light meters for verification; time shall be as required for proper testing of the system.
4. The lighting control system manufacturer shall coordinate all room names and scheduling with the owner prior to final setup.
5. The presence of the system manufacturer's service technicians to assist the installing electrician in all of the above is a requirement of this project and proof of time expended shall be provided to the Owner's Representative.

3.03 SYSTEM COMMISSIONING

A. The electrical contractor shall provide both the Owner and the electrical engineer with a minimum of ten working days written notice of the system startup and configuration date.

B. Refer to the lighting control details that are part of the Construction Drawings for sequence of operation and commissioning requirements of the project lighting control scenarios.

C. All lighting control systems and components shall be commissioned to verify sensor location, time delay/sensitivity is properly set, auto-on/manual-on, override times, controls, day-lighting control, communications between control panels, and timeclock controls are operating as intended.

D. Calibrate all sensor time delays, sensitivity settings and properly aim to guarantee proper detection of occupants and energy savings.

1. Adjust time delay so that controlled area remains lighted for 15 minutes after occupant leaves area.

E. Exterior photocells shall be aimed per the manufacturer's installation instructions. Locate and aim to be facing to the north and avoid being blocked by the building architectural features.

F. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting set points.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

3.04 SYSTEM TRAINING

A. The Contractor shall provide instruction to the Owner's Representative with regard to use and operation of the system. Obtain signed receipt from Owner's Representative that instruction has been given.

B. The lighting control system's manufacturer shall supply at least one (1) service technician after all systems have been tested and in full operation as described above to assist the installing electrician to demonstrate and instruct the Owner's Representative on the operation, programming and any uniqueness of the control system. Minimum time required for Owner instruction of the system is one (1) eight (8) hour session. Provide additional instruction and training to the owner to as required to verify the owner is comfortable with the system operation. Time of demonstration and instruction to be at Owner's convenience during normal working hours and shall be scheduled a minimum of ten working days prior.

3.05 WARRANTY

A. Provide a five year complete manufacturer’s warranty on all products to be free of manufacturers’ defects.

3.06 MAINTENANCE

A. Spare Parts:

1. Provide the following spare parts/components to be used for the owner’s maintenance. The spare parts shall be fully tested for proper operation and turned over to the owner in the original boxes:

a. Digital Light Control System

1) (3) Ceiling mounted occupancy/vacancy sensors
2) (3) Room controllers
3) (2) Digital switches
4) (2) Digital dimmers

5) (1) 500’ of spare cabling that meets the manufacturers wiring requirements.

END OF SECTION

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SECTION 28 09 50

FUEL DISPENSER AND FUEL MANAGEMENT SYSTEM

(ADD ALTERNATE 2)

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers furnishing and installation of gasoline and diesel fuel dispensing, fuel management and reporting system, associated piping and connections, and accessories.

1.02 RELATED WORK:

A. Section 03 30 00 Cast-In-Place Concrete

B. Section 33 56 13 Aboveground Fuel Storage Tanks

C. Section 21 24 00 Fuel Island Fire Suppression System

D. Section 28 40 00 Tank Gauging, Instrumentation, and Controls

E. Division 26 Electrical

1.03 QUALITY ASSURANCE:

A. Install fuel dispensers in accordance with API and NFPA Standards, at a minimum.

B. Installation Contractor shall have a minimum of five years of experience in the installation of fuel dispensing systems.

C. All of the equipment shall be of a proven design and shall have accuracies and ranges within the limits guaranteed by the manufacturers for the models specified.

D. The Specifications and Drawings call attention to certain design features required to provide an operating system meeting the functional description as specified herein. However, the Specifications and Drawings do not purport to cover all details entering into the design. As these systems vary between manufacturers, certain components required by one manufacturer may not be needed by another. The Contractor is responsible for installing a system which meets the functional requirements as stated herein.

E. The equipment described in this specification is based on the products of one manufacturer. This is not to limit competition but to indicate the quality of materials required. Other manufacturers who can provide equipment of comparable quality may be acceptable.

1.04 SYSTEM DESCRIPTION:

A. Contractor shall furnish two (2) single product fuel dispensers with two (2) submersible pumps, one (1) fuel management system, and all required appurtenances for a complete and operational system.

B. The fuel management system shall control access to the fuel dispensing stations as described below and provide information to a computerized data center at the pump island and remotely to any computer connected to the Owner's network, as determined by the owner. Information shall consist of individual quantities dispensed to authorized users plus daily, weekly, monthly quantities and totals of each type of fuel tracked for each user. All necessary software shall be provided, and the system shall be integrated with the Owner's computer network.

C. All necessary wiring, connections, and electrical service requirements shall be provided by the Contractor. All data connections including a RS-422 terminal connection are to be provided by the Contractor.

D. The Contractor shall furnish (3) fuel pump emergency shutoff switches to shut off power to all dispensing devices and all electrical components in the event of an emergency; (2) mounted on the tank and (1) on the electrical cabinet, as shown on the Drawings. At least one emergency shut-off switch shall be placed a minimum of 20-feet away and maximum of 100-feet away from the fuel island per NFPA 30A and, shall be weatherproof and placed within a weatherproof enclosure (NEMA 4X) in accordance with manufacturer's recommendations. In addition, all components of the fuel system shall be weatherproof as appropriate. The Contractor shall provide a sign for the switches labeled "EMERGENCY PUMP SHUTOFF". Approved signs bearing the wording "Extinguish All Smoking Materials", and "Stop Engine While Refueling" shall also be conspicuously posted at both ends of the pump dispensing island visible to approaching vehicles. Approved signs required by NFPA shall consist of block letters not less than two inches in height and be either red letters on a white background or white letters on a red background.

E. Warning signs shall be posted on both sides of the tank next to the dispensers with the following; the "WARNING" and "NO SMOKING – STOP MOTOR" shall be in white block letters not less than one inch on a red background and the rest of the sign shall be in red block letters not less than 1/2-inch on a white background:

<u>WARNING</u>
NO SMOKING – STOP MOTOR

It is unlawful and dangerous to dispense gasoline into unapproved containers.
No filling of portable containers in or on a motor vehicle or trailer.
Place container on ground before filling.

F. The system shall be grounded in accordance with state and manufacturer's requirements. System components shall be explosion proof.

G. Additional signs shall be provided if needed in accordance with local, state and federal requirements. Verify sign requirements with the local Fire Department in advance and modify as needed.

1.05 SUBMITTALS:

A. Submit a complete set of shop drawings showing all interconnections of the components in each system. The Contractor shall show verification that the individual components are fully compatible and capable of performing the tasks.

1. Show complete details of construction and installation for each piece of equipment.
2. Include details of controls and instrumentation wiring.
3. Provide point-to-point wiring diagrams for equipment.
4. Provide a complete functional description of system operations.

B. Submit working drawings showing layout and complete details for piping installation.

C. Furnish proof of successful operating experience during the last five years on ten installations of equipment comparable to that specified.

D. Furnish six copies of the operation and maintenance manuals for each component specified, including a recommended spare parts list with ordering numbers.

E. Furnish written certification by the manufacturer's representative verifying proper installation and function of the equipment.

F. Provide a complete set of design drawings certified by the manufacturer.

G. Contractor shall submit shop drawings showing the proposed pipe routing with appropriate valves and appurtenances necessary in order to provide a complete and operable system, certified by the manufacturer and installer for approval by the Engineer.

PART 2 - PRODUCTS

2.01 SUBMERSIBLE PUMP:

A. Submersible pumps shall pump fuel from the gasoline and diesel fuel compartment of the ASTs to tank mounted dispenser. Provide one (1) gas and one (1) diesel dispenser, as shown on the Drawings.

B. Contractor shall furnish pumps, piping, dispensing station, electrical interconnections and all accessories required to provide complete dispensing and data management systems. Provide two (2) submersible turbine pumps, Franklin Fueling Systems FE Petro Model *STP75*, one (1) - 3/4 HP for gas and one (1) - 1.5 HP for diesel fuel. Both pumps shall be fixed speed, 3,400 rpm, two stage centrifugal type pumps, or approved equal. Incoming power shall be single phase, 208-230 VAC, 60Hz, as shown on the Electrical Drawings. The pumps shall have integral, automatic thermal overload protection. The maximum flow rate shall be 65 gpm and max pressure of 31 psi. The starting and running capacitor with internal bleed resistor shall be rated 370 Volt, 15 microfarad and have a maximum motor draw of 7 amps. Pumps shall be UL and cUL listed for fuel mixtures containing up to 10% ethanol with gasoline and 20% MBTE, 20% ETBE, or 17% TAME with gasoline. The pumps shall also be equipped with a pressure relief check valve.

C. Contractor shall provide necessary fittings/piping to connect submersible pump to Schedule 40 steel fuel lines (coated per manufacturer requirements for corrosion protection) and to provide a complete and operable system as shown on the Drawings and as recommended by the manufacturer. The gasoline pump shall pump to two dispensers, and the diesel pump shall pump to two dispensers as shown on the Drawings.

D. Pump shall be approved by the manufacturer for use with gasoline and diesel fuels.

E. Submersible pump shall be provided with a smart pump controller in accordance with manufacturer recommendations. The pump controller locations shall be selected by the fuel system contractor with approval by the owner and engineer.

H. Contractor shall provide necessary controls to run the pump.

I. Pump controllers shall be interlocked with the tank gauging and monitoring system controller specified in Section 28 40 00 Tank Gauging, Instrumentation and Controls. The monitoring system controller shall be capable of shutting off the submersible pump if any operator-defined system conditions are not met or if any other operator-defined fueling system associated alarm is activated.

J. Pump shall be equipped with an automatic mechanical line leak detector.

## 2.02 FUEL MANAGEMENT SYSTEM

### A. General Description

This specification establishes the performance and design requirements for an Automated Fuel Management System that will control and record the dispensing of fuel. The vendor shall provide a stand-alone system, capable of unattended operation for 7 days a week, 24 hours a day. Fuel products shall be limited to equipment and operators with authorized keys. The fuel management system (automated data collection system) shall reliably read all keys and can lock out any key. The fuel management system shall be Fuel Master 2500 Plus or approved equal. Contractor shall provide 120 keys that are compatible with the approved fuel management system.

### B. Applicable Documents

The equipment must be designed to meet the following specifications:

- National Electrical Code, NFPA #70-1999
- Uniform Fire Code
- Underwriters Laboratories 1238
- FCC, Part 15, Class A

### C. Performance

1. **System Components**. The fuel management (automated data collection) system shall, as a minimum, consist of the items described below.

   a. Read/write keys will be used to activate the system by using a proximity sensor and will be unique to each vehicle, user, supervisor or tanker truck. Keys shall attach to vehicle key rings. Keys should be capable of being written to 100,000 times, and vehicle keys should contain the previous transaction mileage and range for reasonability check. Quantity and product restrictions are also to be encoded on keys. Keys must have gold plated contacts and pins. Keys cannot require a turning or twisting motion to activate the system.

   b. A key reader device, located on the fuel island, is used to turn fuel dispensers on and off, monitor fuel dispensed, recognize authorized keys, and interface with existing dispensers and tank level monitoring systems. The island fuel management unit should have a 32bit processor and preferably a Rockwell socket modem to permit upgrade of modem. Modem should be at least 33.6kbps. The receptacle for reading keys must be covered to prevent sand, water and snow from causing system problems.

   d. A key encoder interfaces with the Central Controller to permit transferring data onto keys.

e. Software is installed on an IBM compatible PC, permitting the encoding and re-encoding of keys; manipulation of transaction data for printing reports on vehicles, users, products, etc.; downloading of transactions and uploading of authorized user/vehicle lists and transfer and storage of data. A Windows version of software must be available, and software must operate on Windows 95,98, ME, 2000, and NT platforms. The fuel management system software must permit the use of a file server and client workstations. Transaction data may be transferred to any program accepting a flat ASCII file. Software must include an invoicing capability that allows the user to generate invoices for selected customers or agencies from the central controller printer. Invoices must list each transaction for all vehicles for a user-selected period.

f. Tanker truck (mobile) key readers, that perform identically to island key readers in controlling and monitoring fuel, must be available.

2. **System Configuration**. The equipment and software shall be capable of operating in the five different system access configurations listed below (operating as either a one key or two key system with driver providing keypad input). The system configurations listed below which use a vehicle key shall support the option of terminating a transaction (thus not permitting refueling) if a vehicle's odometer reading is out of the range encoded on its key. The Owner shall have the option of selecting the initial configuration and the option of changing the configuration at a later date should operational requirements so dictate.

- Vehicle key and verifiable driver number
- Vehicle key and unverified driver number
- Vehicle and driver key
- Either vehicle or driver key
- Driver key and verifiable vehicle number

a. Vehicle Keys. Data on Vehicle Keys is as follows:
   - Key identification number
   - Vehicle budget or agency number
   - Vehicle license number
   - Fuel type (allows pumping of designated fuel type only)
   - Maximum number of gallons/units allowed per transaction for each product type
   - Odometer or hour reading
   - Preventive maintenance reminder (oil change mileage, etc.)
   - Site signature to identify the applicable owner's system

b. Driver keys, if used in lieu of having the driver enter an ID number on the island key reader keypad. Driver keys will be encoded with the following information:

   - Key identification number
   - Driver identification number

- Types of products authorized
- Product limitations
- Budget or agency number
- Site signature

c. Supervisor Keys. Supervisor keys shall allow the on-site supervisor special access to the site's key reader. This access allows the supervisor to:

- Change the key reader's configuration, to include time/date, product codes, hose numbers, tank numbers, pulser divide rate, no pulse time out, key timer setting, pump finish timer, message duration setting, zero-quantity shutdown, and pump handle switch control
- Issue fuel
- Update a vehicle key's PM flags
- Activate semi-manual mode of fuel issue
- Initiate on-site reports generation
- Enter fuel drops and corrections to fuel drops
- Perform diagnostic testing of system components

3. **System Capability.** Each island key reader shall have the ability to simultaneously control up to eight (8) hoses and control up to eight (8) satellite units, which in turn can simultaneously control up to eight (8) hoses. Each master and each satellite key reader shall store a minimum of 4,000 transactions. The system shall be capable of performing as a gate opener using switch closure. Also, the system shall provide the option of providing a less expensive gate opener, which is not a complete key reader unit. The fuel management system shall also be capable of controlling bulk or canned oil, antifreeze, CNG and other alternative fuels or liquid products. The system must have the capability to mount a key reader on a tanker truck to act as a mobile refueling site.
Each hose shall be individually set for any number of pulses between 1 and 1000 for each unit of measurement. Thus, the system can use various rate pulsers to measure different products to various levels of accuracy.

4. **Operator Input at Fueling Station**. The system shall include a key reader with a liquid crystal display (LCD) using light emitting diodes (LED) with back light, that is a minimum of 2 lines by 40 characters. It must also include a numeric keypad (0 through 9, A through D, Enter/Yes, and Clear/No) located near the pumps. The operator shall be prompted by the LCD to input information, that shall be recorded as part of the transaction record, for each transaction in accordance with the system configuration of paragraph 3.2 above. The driver will insert his/her key into the island key reader, and upon queue from the system prompts will enter his/her ID number and odometer reading, and select a pump.

D. Data Management and Reporting.

1. Each island key reader may be downloaded by the central controller operator at his/her convenience, or at a time of day programmable by the central controller operator. When automatically downloading, the system shall dial each site in sequence and generate a report of all transactions for individual sites once each 24-hour period. The system must be capable of unattended dialing and downloading, thus permitting downloading when sites are not in use and when phone rates are less. The software shall operate on an IBM compatible PC using Windows 98 or higher. The software shall permit networking.

2. The system shall provide the following information at the central controller as a transaction record:

   a. User identification number.
   b. Vehicle odometer or hour reading.
   c. Vehicle Number.
   d. Number of units (gallons, quarts, cubic feet, therms, etc.) dispensed to tenths, hundredths, etc.
   e. Fuel site.
   f. Data & time.
   g. Hose number.
   h. Product number.
   i. Key type

3. The system shall be capable of totaling monthly fuel costs by organization number, vehicle ID number, agency number, and user number.

4. The system shall keep a declining balance inventory of fuel remaining in storage. The inventory report shall give a summary of the remaining fuel in each storage tank monitored. It must also note when fuel should be purchased for a specific tank.

5. The system shall allow the operator to compile summary reports for all transactions by site, organization, date, vehicle, etc.

6. All vehicles due for preventive maintenance shall be printed as an exception report on the central controller's printer, provided the PM option is used.

7. All vehicles that have an out of range odometer reading shall be printed as an exception report on the central controller's printer.

8. The central controller shall be capable of displaying reports on the central controller monitor before the reports are printed. When reports are displayed on the monitor, the user shall be capable of scrolling up and down to view any page of the report.

9. **Storage.** In the event of a power failure to the island key reader equipment located at the pump, the system shall have the capability to store all data collected up to the time of the power failure for a minimum period of three months. The equipment at each

fueling site must have the ability to operate if the central processor is down, limited only by the key reader's internal storage capacity. There shall be a method to access dispenser transaction information should there be data transmission problems. The main board, with memory, shall be removable and must be capable of being installed in an operating unit and downloaded; or, if the central controller is inoperable, another central controller shall be capable of downloading data. Support for recovering data from the system shall also be provided by the factory when required.

C. **Required Features.** These required features must be available, without exception.

3. **True Manual Override.** The system shall permit manual override of the fuel management system should any problem occur. The override must be a complete, total by-pass of the fuel management system. Thus any requirement that parts of the fuel management system be operational for the manual override to function, for example, emit fiber optic signals, etc. is unacceptable.

5. **Self-diagnostic capability**. The island key reader shall permit diagnostic testing of boards, LCD, and keypad using the supervisor's key.

6. **No-twist Key**. The key used to activate the system cannot require a turning or twisting motion. Information must be read from the key by merely inserting the key straight into a key receptacle.

8. **Toll Free Support**. The vendor shall provide toll free support during the warranty or extended maintenance period for the hardware and software that is being bid.

9. **Extended Maintenance Agreements**. The vendor shall offer extended maintenance agreements on an annual basis for the life of the system (minimum 10 years).

10. **Customer School.** The vendor shall provide a customer school for the training of system operators. There should be no charge for the school other than transportation, hotel and per diem.

11. **Surge Protection.** The system shall have surge (lightning) protection on the AC power line and on the telephone line. Surge protection shall be designed specifically for the voltage and current requirements of fuel management systems.

12. **Modifiable Prompts.** The system shall have the capability to customize the initial entry prompt, user ID and vehicle ID prompts.

17. **Environment**. The vehicle operator interface with the equipment will be outdoors and exposed to the elements. Thus, the fuel island unit must have an operating range of -60 degrees F to +140 degrees F and withstand rain, snow, and blowing sand. The system shall have been tested by an independent environmental testing organization to provide outside affirmation of environmental limits.

18. **Services**. This equipment shall be designed to operate from 120 volt AC, 60 Hz single phase power.

20. **Training**. The supplier shall provide on-site training of personnel in the functions of operation, maintenance, and repair as they apply to each specific item of equipment. Supervisors and operators at each refueling site will be provided training in the operation of the island fuel management units. Training on software may be conducted on-site or via a remotely located computer on line with the central controller (PC) operator.

21. **Automatic Reconciliation.** The fuel management system shall be equipped with a tank monitoring interface kit, to permit automatic reconciliation of tank levels. Fuel Managements shall be compatible with the tank monitoring system.

22. **Warranty.** The Manufacturer shall warrant parts for the equipment supplied for a period of one (1) year. Read/write keys shall be warranted for five (5) years. All replacement part, including but not limited to replacement keys, shall be provided by the Manufacturer for this one (1) year period, except those required by acts of nature (i.e., flood, lightning, etc.). All telephonic support labor for diagnostics and assistance shall also be provided.

2.04 TANK MOUNTED DISPENSERS:

A. Provide two (2) shelf-mounted dispensers. The dispensers shall distribute a single product through a single hose to Universal double poppet shear valve and shall be capable of delivering up to 22 gpm for gasoline and 30 gallons for Diesel fuel. For diesel fuel, one diesel pump shall be connected to two diesel dispensers, with appropriate piping manifold and isolation shut-off valves so the dispenser can be shut off/isolated from the pump with appurtenances as needed. For gasoline, one gasoline pump shall be connected to two gasoline dispensers, with appropriate piping manifold and isolation shut-off valves so the dispenser can be shut off/isolated from the pump with appurtenances as needed.

B. The diesel dispenser shall be complete with the following features:
   1. Super high capacity shelf-mount single remote dispenser with lane-oriented nozzle (1-inch nozzle for diesel), which is rated up to 30 GPM/114 LPM at the discharge. Designed for dispensing diesel, including biodiesel blends up to 20%; gasoline, including ethanol blends up to E25; and kerosene.
   2. Compact design 31-inches or less in height that can be mounted on a shelf attached to a tank.
   3. Class 1, Div. 2 hazardous location rated for installation directly next to an aboveground storage tank.
   4. Electronic display. Mechanical register is not acceptable.
   5. On side with nozzle boot, backlit 7-digit 1.5-inch liquid crystal (LCD) gallons display.
   6. Display backup for a minimum of 15 minutes in the event of power loss.

7. Thermostatically controlled heater fan for cold temperatures.
8. Four-character ½-inch LCD operator message display to denote authorization status, cut-off limit, etc.
9. Separate display for error codes and indicating operating mode
10. All displays covered with tempered or double-strength glass (plastic not acceptable).
11. 120VAC, 60 hz operation.
12. Electromechanical totalizer, 7-digit non-resettable, located on front of dispenser for inventory control.
13. Electronic 6-digit non-resettable and resettable totalizers.
14. Diagnostics including log of last 50 errors/events. Dispenser software configurable and downloadable from PC.
15. Hand held remote control for accessing totals, diagnostics, & configuring dispenser via LCD w/o opening cabinet.
16. Dual pulse output interface for connection to fuel control and tank monitoring systems.
17. Cabinet: All exterior panels made from galvannealed steel for corrosion-resistance. Side panels 14-gauge minimum.
18. Finish: Powder-coated metallic silver sides, top, and base with green lower doors.
19. Front and rear doors shall be removable for dispenser service.
20. LED lighted brand panel labeled Diesel.
21. Lane-oriented nozzle boot with lift-to-start nozzle hook to turn on/off dispenser.
22. Hose mast with heavy duty spring base and top swivel connector to ease handling of hose.
23. Two (2) positive displacement, two-piston meters connected to the same discharge for maximum flow.
24. Integral hall effect pulsers with no external parts to wear out.
25. Electronic calibration without the need to set mechanical adjusters.
26. Proportional solenoid valve on discharge of each meter, programmable thru electronic register to set maximum flow rate.
27. One (1) internal filter with 30-micron element to help ensure product purity.
28. One (1) 1-inch discharge outlet with a ¾-inch reducing bushing so that either a ¾-inch or 1-inch hose may be used.
29. One (1) 1.5-inch NPT inlet.
30. Terminal block in the electronic register to make all dispenser power and control wiring terminations.
31. Shelf bracket for mounting dispenser to tank. Black powder coat finish. Bracket for securing emergency valve.
32. Shelf Bracket P/N WP001128-0001-J021
33. Warranty: Two years parts and labor.

34. Standards/Approvals: ADA compliant user controls per ANSI A117.1; c-UL-us listed; FCC; W&M approvals.

35. Model & Manufacturer: Wayne Select S1 Model 3/G7127D/9GHRU/JL (Wayne Fueling Systems, Austin, TX) or approved equal.

36. Universal Valve anti-static discharge Model Zapper.
37. Provide UL listed diesel hoses (10ft max) with necessary high flow dispenser nozzles, hose support and retraction systems and breakaway valves.
38. Contractor shall provide all piping between the dispenser and the tanks including all fittings, valves, line strainer, external emergency valve, anti-siphon valves, unions, pressure relief valves, solenoid valves, ball valves, and vapor recovery piping as needed for a complete and operable system, which will allow for thermal expansion and trouble free operation.

D. The gasoline dispenser shall be complete with the following features:

1. Enhanced capacity shelf-mount single remote dispenser with lane-oriented nozzle (3/4-inch nozzle for gasoline), which is rated up to 22 GPM/83 LPM at the discharge. Designed for dispensing gasoline, including ethanol blends up to E25; diesel, including biodiesel blends up to 20%; and kerosene.
2. Compact design 31-inches or less in height that can be mounted on a shelf attached to a tank.
3. Class 1, Div. 2 hazardous location rated for installation directly next to an aboveground storage tank.
4. Electronic display. Mechanical register is not acceptable.
5. On side with nozzle boot, backlit 7-digit 1.5-inch liquid crystal (LCD) gallons display.
6. Display backup for a minimum of 15 minutes in the event of power loss.
7. Thermostatically controlled heater fan for cold temperatures.
8. Four-character ½-inch LCD operator message display to denote authorization status, cut-off limit, etc.
9. Separate display for error codes and indicating operating mode
10. All displays covered with tempered or double-strength glass (plastic not acceptable).
11. 120VAC, 60 hz operation.
12. Electromechanical totalizer, 7-digit non-resettable, located on front of dispenser for inventory control.
13. Electronic 6-digit non-resettable and resettable totalizers.
14. Diagnostics including log of last 50 errors/events. Dispenser software configurable and downloadable from PC.
15. Handheld remote control for accessing totals, diagnostics, & configuring dispenser via LCD w/o opening cabinet.
16. Dual pulse output interface for connection to fuel control and tank monitoring systems.

17. Cabinet: All exterior panels made from galvannealed steel for corrosion-resistance. Side panels 14-gauge minimum.
18. Finish: Powder-coated metallic silver sides, top, and base with blue lower doors.
19. Front and rear doors shall be removable for dispenser service.
20. LED lighted brand panel labeled Unleaded.
21. Lane-oriented nozzle boot with lift-to-start nozzle hook to turn on/off dispenser.
22. Nozzle boot shall accommodate UL standard interchangeable nozzles and short spout vapor recovery nozzles.
23. Hose mast with heavy duty spring base and top swivel connector to ease handling of hose.
24. One (1) positive displacement, two-piston meter with integral hall effect pulser with no moving parts to wear out.
25. Electronic calibration without the need to set mechanical adjusters.
26. One (1) proportional solenoid valve, programmable through electronic register to set maximum flow rate.
27. One (1) internal filter with 30-micron element to help ensure product purity.
28. One (1) 1-inch discharge outlet with a ¾-inch reducing bushing so that either a ¾-inch or 1-inch hose may be used.
29. One (1) 1.5-inch NPT inlet.
30. Terminal block in the electronic register to make all dispenser power and control wiring terminations.
31. Shelf bracket for mounting dispenser to tank. Black powder coat finish. Bracket for securing emergency valve.
32. Shelf Bracket P/N WP001128-0001-J021
33. Warranty: Two years parts and labor.
34. Standards/Approvals: ADA compliant user controls per ANSI A117.1; c-UL-us listed; FCC; W&M approvals.
35. Model & Manufacturer: Wayne Select S1 Model 3/G7107D/29GHRU/JL (Wayne Fueling Systems, Austin, TX) or approved equal.
36. Universal Valve anti-static discharge Model Zapper.
37. Provide UL listed gasoline hoses (10ft max) with necessary high flow dispenser nozzles, hose support and retraction systems and breakaway valves.
38. Contractor shall provide all piping between the dispenser and the tanks including all fittings, valves, line strainer, external emergency valve, anti-siphon valves, unions, pressure relief valves, solenoid valves, ball valves, and vapor recovery piping as needed for a complete and operable system, which will allow for thermal expansion and trouble free operation.

2.04 INSTALLATION:

A. All equipment and software covered under this section shall be installed in accordance with the requirements of the Owner.

B. The Contractor shall supply any wires, cables or power cords necessary for proper installation of the computer system and not supplied with equipment, at no additional cost to the Owner.

2.05 WARRANTY:

A. The system must include a one-year warranty on all components covering parts and on-site labor. A factory-trained Authorized Service Representative (ASR/ASC) must be located within 50 miles of the site. A one-year preventive maintenance program will also be furnished by the manufacturer.

2.06 TRAINING:

A. A factory-trained Authorized Service Representative (ASR/ASC) shall provide a minimum of four hours of training as needed to train Owner's personnel to use the system.

2.07 EMERGENCY SPILL KIT

A. Contractor shall provide and install an emergency spill kit, which shall contain at a minimum:

1. 55 Gallon poly-drum with lid
2. 50 sorbent pads
3. 12 sorbent socks
4. 5 sorbent pillows
5. 2 pairs of goggles
6. 2 pairs of gloves
7. 2 disposable bags
8. 2 Tyvek suits

PART 3 - EXECUTION

3.01 INSTALLATION/TESTING

A. Install all systems to comply with API and NFPA Standards and Manufacturer's installation instructions. Provide a complete and operational system and include all components and accessories, as required for a complete and operational system. All wiring shall comply with the NEC.

B. The manufacturer's engineering consultant will be required to furnish a point to point

interface wiring diagram.

C. Contractor shall pay for and obtain all permits required for installation and operation of the fuel dispensing and management system.

D. All equipment and materials shall be inspected for damage sustained during shipment.

E. Contractor shall coordinate installation of fuel dispensing system with installation of the fuel tanks.

F. All electrical materials and installations shall be in accordance with code requirements and as required by the local Fire Department and State building codes.

G. Installation of computerized fuel management data system software on the desktop computers shall be coordinated with Owner personnel.

H. The completed installation shall be inspected by an authorized manufacturer's representative and certified to be satisfactory in writing. The Fire Marshall shall also indicate acceptance before testing can be initiated.

I. The system shall be tested in the presence of the Owner's representative and others as required, to the Owner's satisfaction.

J. Owner's operating personnel shall be trained in all aspects of system operation by a qualified manufacturer's representative, using the operating manuals provided.

K. The system shall be grounded in accordance with local, state and federal regulations, and in accordance with the manufacturers' recommendations. The system shall be explosion proof.

M. The Specifications and Drawings show the general system components and not all components are specified. The Contractor is responsible for providing all equipment, materials, labor, and components necessary for a complete, fully permitted and operable system in accordance with local, state, and federal regulations, and in accordance with manufacturer's recommendations.

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SECTION 28 31 02
ANALOG ADDRESSABLE FIRE ALARM SYSTEM

## PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation of a fully operational analog addressable fire alarm system and related Work as described in the Contract Documents.

B. Provide system as approved by local Fire Marshal and the Authority Having Jurisdiction (AHJ). System materials and installation shall be in accordance with the manufacturer's recommendations.

1.02 QUALITY ASSURANCE

A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with NFPA-70 (National Electrical Code), NFPA-72 (National Fire Alarm Code), AHJ, state codes, local codes, requirements of authority having jurisdiction and the contract documents. Installer shall be certified in the State of New York for fire alarm installation.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published UL, NFPA, ANSI, NEMA and IEEE Standards. All system equipment shall be compatible and of the same manufacturer.

D. Each item of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer and shall bear the UL Label.

E. System installation shall be under the supervision of an accredited factory representative. Final connections to the FACP, annunciator panel and any other panels shall be by the factory representative.

F. The system provider must:

1. Provide equipment from a single manufacturer for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years minimum.
3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day, 365 days per year and staff must be adequate to respond within 2 hours of an emergency call.
4. Have a service location not more than 50 miles from the project location.
5. Maintain adequate spare parts inventory to provide both normal and emergency service.
6. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.
7. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.
8. Provide all system programming to deliver a customized system to the Owner ready for use.
9. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.
10. Provide a minimum of two system inspections/tests each year during the warranty period as described in NFPA 72. Needed and requested system programming changes shall be provided at these times.
11. Warranty period shall be as described elsewhere with two years being minimum. Provide a service contract for the Owner review for two years beyond the warranty period. Warranty shall include all parts, materials, labor, transportation, etc.

1.03 SYSTEM DESCRIPTION

A. The system shall constantly monitor all initiation devices and notification circuits for any abnormalities or alarm conditions. System shall sample/poll each addressable device no less than every 10 seconds.

B. The system operation subsequent to the alarm activation by any initiating device (manual station, automatic detector, sensor, etc.) shall be as follows:
1. All audible alarm notification appliances within corresponding building or designated area shall provide a common audible fire alarm signal until the System Reset Key or the Signal Silence Key is depressed.
2. All visual alarm notification appliances shall flash continuously and synchronized until the system is reset or silenced.

3. The remote central monitoring station shall be notified automatically until the System Reset Key or the Signal Silence Key is depressed.
4. Shutdown of the corresponding HVAC system equipment shall occur with a supervisory alarm until the system is reset. All fans over 2,000 cfm shall be shut down.
5. Activation of all programmed outputs assigned to the initiating device shall occur until the system is reset or the silence key is depressed.
6. The alarm shall be displayed at the local Fire Alarm Control Panel (FACP) and the fire alarm annunciator panel. A printout shall be produced at the FACP.
7. The system alarm LED shall flash on the control panel and the fire alarm annunciator panel until the alarm has been acknowledged/reset. Once acknowledged, this same LED shall latch on. A subsequent alarm received shall flash the system alarm LED on the control panel and annunciator. The LCD display shall show the new alarm information.
8. A pulsing audible alarm tone shall occur within the local building control panel and, where applicable, the fire alarm annunciator panel until the event has been acknowledged.
9. Alarms shall be entered into the system event log history.
10. Refer to Appendix A for operational/sequence matrix.

C. Any subsequent alarm shall follow the operation described above.

D. The activation by any system smoke detector or sensor shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within a preset time after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within the prescribed time, the system shall resume normal operation. The alarm verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by device.

E. A manual evacuation (drill) switch shall be provided to operate the alarm notification appliances without causing other control circuits to be activated. However, should an actual alarm occur, all alarm functions shall occur as described previously.

F. The system shall have a password(s) to allow the operator to display all alarms, troubles, and supervisory service conditions log history including the time of each occurrence. This shall be able to be viewed from the front of the control panel, annunciator panel or from a computer connected to the FACP.

G. The actuation of the " walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:

1. The remote central monitoring station connection shall be bypassed.

2. Only audible and visual appliances shall be operated. Other alarm functions (elevator recall, HVAC shutdown, etc.) shall not be affected.
3. Walk test shall be selectable by circuit or circuits.
4. Actual alarms received during a "Walk Test" shall cause the control panel to go into alarm and override the walk test mode.
5. The control panel shall show trouble conditions.
6. The walk test activation of any initiation device shall cause the audible signals to activate for two seconds or a distinguishable audible.
7. The panel shall automatically reset itself after signaling is complete.
8. The control panel shall automatically return to normal condition if there is no activity on a walk test circuit for a period of 30 minutes.

H. Any momentary opening of an initiating or notification appliance circuit wiring shall cause an audible signal to sound at the Fire Alarm Control Panel and, where applicable, the annunciator panel for four seconds indicating a trouble condition.

I. Duct mounted smoke detectors associated with duct dampers shall have an addressable control module to operate the duct damper. In the event of an alarm initiation by the duct mounted smoke detector or the associated air handling unit/fan shut down the duct damper shall be closed. Control wiring shall be provided to shut the damper(s) when the associated air handling unit is not operational. Provide power supplies, wiring and accessories as needed for this operation.

J. Provide a minimum of two Form C contacts at the building's fire alarm control panel. This contact shall activate upon activation of any fire alarm initiating device.

1.04 SUPERVISION

A. The system shall utilize independently supervised initiation device circuits. The alarm activation of any initiation device shall not prevent the subsequent alarm operation of any other initiation device.

B. Notification appliance circuits shall be supervised to indicate an open or short circuit condition.

C. The incoming power to the system shall be supervised so that any power failure must be audible and visually indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present. This shall be a trouble alarm.

D. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and the remote annunciator. This shall be a trouble alarm.

E. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.05 SUBMITTALS

A. Provide a complete system submittal prior to ordering of equipment and installation including but not limited to:

1. Complete equipment list.
2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.
3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.
4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting, control circuiting and any system applicable building characteristics (ceiling heights, structural members impeding detection, etc.). Contact the Engineer for an electronic copy of the project floor plans. Engineer logo shall be included in final drawing.
5. Typical Terminal Wiring Diagram for each type of device.
6. Terminal wiring Diagram for all Fire Alarm equipment.
7. Calculations including:
   a. Battery sizing calculations indicating total number of power devices, load associated with each type device, backup period and recommended battery capacity (AH).
   b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.
8. Complete console enclosure and equipment configuration.

B. Submittal package, calculations and system wiring shall be performed/collected/signed by a NICET Level III technician.

C. If required by the Authority Having Jurisdiction (AHJ) provide a submission of all requested information for review and comment by the AHJ. All AHJ comments shall be incorporated and resubmitted until approved.

D. Test reports at the completion of the project. Testing shall be of all system devices, equipment, circuits, features and functions.

**PART 2 - PRODUCTS**

2.01 ACCEPTABLE MANUFACTURERS

A. The project fire alarm system shall comply with and be in accordance with the drawings and specifications. All system equipment and materials shall be of the same manufacturer unless otherwise indicated. System and component acceptable manufacturers include the following unless otherwise indicated:

1. Notifier (Basis of Design)
2. Simplex - JCI
3. Siemens - Cerberus
4. EST - GE

2.02 FIRE ALARM SYSTEM

A. The fire alarm system shall be comprised of the components specified as a minimum and also include components not indicated but required for a complete and operable system as described herein.

B. The system and all its components shall be UL listed and in accordance with NFPA 72, local and state codes.

C. The system shall have 25% spare capacity. This shall include all individual notification circuits, initiation circuits, initiating modules, alarm modules, power supplies, batteries, central processing unit memory and printed circuit card space. System initiation device and control device capacity shall be a minimum of the indicated percentage over the shown quantity or 250 whichever is greater.

D. Each initiating device shall have an individual address for system communication. The system addresses shall not exceed seven digits. Each address, initiation circuit, notification circuit and control point shall have an individual identification description.

E. System shall shut down all air handlers more than 1,000 cfm upon an alarm.

2.03 FIRE ALARM CONTROL PANEL (FACP)

A. The system shall be entirely solid state, microprocessor based, use digital transmission and shall be field programmable. All system programming including field modifications shall be stored in non-volatile memory. Field modifications shall be automatically stored without special actions. The panel shall be designed and manufactured expressly for the intent to detect the presence of fire and to provide indication of such detection. Panel shall contain as a minimum power supply(s), control module, main control printed circuit board, initiation modules, notification modules, terminals and back up battery(s). Control module shall have 80 character backlit LCD display and twelve control buttons (four being field assignable), minimum. Display shall indicate the battery voltage at all times.

B. The system shall be modular in design to allow for future expansion with a minimum of hardware additions.

C. The FACP shall be located where shown on the drawings. Enclosures shall accept all system items for an aesthetically suitable operator's console. Enclosures shall be of modular size to allow surface mounting of multiple boxes adjacent to each other, shall have hinged solid metal doors and contain a lock with a key common to all system devices. Enclosure shall have a red finish.

D. The FACP shall operate its integral LCD Display through an RS-232C port operating up to 9600 baud to indicate all operator transactions, alarms, trouble reports and any other conditions specified by system programming.

E. Conditions of the system shall be indicated at the operator interface by LED's. These conditions shall be alarm, supervisory, trouble and alarm silenced. An LCD 2 line, 40 character per line display shall also be included. It shall display "SYSTEM IS NORMAL" with the date and time under normal circumstances. The LCD display shall also indicate type of alarm, point status, number of alarms and location. Through the use of function keys, historical data can also be displayed.

F. The FACP shall include a password (three (3) levels of protection with individual passwords, minimum) protected key pad for access to programming, special functions and all system features.

G. Any event initiated by the FACP due to an alarm input shall be retained in nonvolatile EPROM memory. The FACP shall also have sufficient memory for 1200 individual alarm/trouble events.

H. The FACP shall have the following user connection types:

1. Ethernet connection for a computer, personal data device or printer. Connection shall allow for programming changes, history download, setting review/changes, etc.

2. RS 232 port for connection of a serial printer.

I. Battery and charger shall be as specified within this section.

J. Design Equipment: Notifier NFW-100X.

2.04 VENTILATION FAN SHUTDOWN CONTROL

A. Provide supervised normally closed relays and contactors for connection into the fan motor control circuits ahead of all automatic devices.

B. Sequence fan shutdown for every air distribution system over 1,000 cfm. Provide duct detectors in return of systems over 2,000 cfm and in return at each floor of systems over 15,000 cfm.

C. Provide drill bypass feature, locate switch on Fire Alarm Control Panel and label "DRILL-FAN SHUTDOWN BYPASS". Buzzer shall sound continuously while in bypass mode.

D. Provide fan reset feature, locate switch on Fire Alarm Control Panel and label "FAN RESET".

2.05 INITIATION DEVICES

A. General:

1. Provide analog addressable smoke and thermal sensors as shown. All detectors, control modules, monitor modules and all other initiation devices shall communicate with twisted pair cable and have an individual address. Peripheral devices shall be of the some manufacturer as the FACP.
2. Spot type detectors shall utilize the same interchangeable bases.
3. If a device is removed or taken out of service a trouble signal shall be initiated.

B. Photo-Obscuration Type Smoke Detector:

1. The photo-obscuration detector shall operate on the photo electronic principle and provide an analog signal to the system indicating the amount of smoke. Detector shall be an analog addressable type.
2. The detector shall incorporate a built in type identification so the system can identify the type of detector. The sensor shall be continually monitored to measure any change in their sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). Unit shall not be affected by exterior light or EMF.
3. The detector shall be designed and arranged to prevent interference from exterior electromagnetic fields and light.
4. The detector shall provide advance indication of the analog value of the products of combustion to the FACP indicating that maintenance is required in order to insure normal operation. The detector sensitivity shall be adjustable per device (within UL limits) and be set at the FACP for continuous or variable based on time of day. There shall be a minimum of six (6) selectable sensitivity levels. The individual detector sensitivity setting shall be adjusted to meet the building/space characteristics and operation. The detector shall monitor the obscuration continuously and raise the obscuration level to compensate for a dirty sensor to maintain the set sensitivity.
5. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide manufacturer's recommended back box suitable for surface mounting where required.
6. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector to the base with a concealed socket headscrew to prevent unauthorized tampering.
7. Smoke detectors shall be UL 268 listed and FM approved.

8. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise and any Owner requests. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

9. Photo-obscuration type smoke detection shall be used for smoke detection unless indicated otherwise indicated.

C. Heat Detector:

1. The heat detector shall be a thermal sensor and shall constantly monitor the space temperature and constantly report this to the system. The unit shall be analog addressable.

2. The sensor shall use dual solid state thermistors and shall monitor the ambient temperature from 32 degrees F, to 155 degrees F and provide a fast response to rapid increase in temperature. The sensor shall send data to the FACP representing the analog value of the ambient temperature. The FACP shall be suitable to monitor for set temperature (selectable by detector for 135 or 155 degrees F) and rate of rise (selectable by detector for 15 or 20 degrees F per minute). Individual detector thermal settings shall be adjusted for the building/space characteristics and operation but shall initially be set to 135 degrees F set temperature and 15 degrees F per minute rate of rise.

3. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide back box suitable for surface mounting where required.

4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket headscrew to prevent unauthorized tampering.

5. Smoke detectors shall be UL 268 listed and FM approved.

6. All thermal sensors shall be field checked and set to meet the prevailing conditions of the premise. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

D. Addressable Initiation Module:

1. The addressable initiation module shall be used to connect supervised conventional initiating device or zone of supervised conventional initiating devices (water flow switches, tamper switches, manual pull stations, (4) wire smoke detectors, conventional (4) wire duct detectors, fire pump alarms, dry chemical fire extinguisher control panels, etc.) to one of the system's addressable circuits.

2. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device.

3. The module shall contain an integral LED that flashes each time the unit is polled.

E. Manual Pull Stations:

1. Noncoded pull-down type, double action (push then pull down) manual addressable units with front keyed test/reset. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Each unit shall have a distinct address. Units shall be key reset.
2. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
3. Bright red finish with white lettering "FIRE ALARM".

F. Duct-Type Smoke Detector:

1. Detector shall be a photoelectric type that shall be activated by the presence of combustion products.
2. The detector head shall be a plug-in unit. The unit shall contain no moving parts. One chamber shall be for fire detection and the second chamber shall function as a reference, to stabilize the detector for changes in environmental temperature, humidity and pressure. It shall be possible to electrically check detectors sensitivity, using a sensitivity test set, or equivalent, and readjust the detectors sensitivity as required.
3. Housing shall have ports for testing and a clear cover panel.
4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket-head screw to prevent unauthorized tampering.
5. Smoke detectors shall be listed by Underwriter's Laboratories, Inc. and approved by Factory Mutual Insurance Company.
6. Provide complete with sampling tubes. Size sampling tubes for 80% of the width of the duct. Locate in ductwork for the indicated system and in accordance with the manufacturer's recommendations. Unit shall be rated for air velocities of 300 to 4000 fpm as a minimum.
7. Provide addressable control module and 120V power for smoke damper operation.
8. Provide a remote indicating light/key test switch for each duct detector and mount directly below each duct detector on the underside of the ceiling where the detector is concealed.
9. Provide addressable base.

G. Carbon Monoxide (CO) Detector:

1. Detector shall sense the level of CO concentration within a space and provide analog addressable signal to the system and be UL 2075 listed. Unit shall have a minimum life span of 10 years without replacement/recalibration.

2. Provide with audible notification base unit for local unique notification. Alarm and notification initiation shall be from the control panel.
3. Detector shall connect to the system addressable circuiting.
4. Alarm level shall be adjusted at the control panel. Upon an alarm the local notification shall sound and a trouble alarm initiated.

2.06 NOTIFICATION APPLIANCES

A. Horns:

1. 24 volts DC.
2. Basic grille type with powder coated red finish paint.
3. Horn shall be rated 94 dBA (anechoic chamber) at 10 feet. Output shall be selectable steady tone or coded. Provide dampening devices to reduce unit output by 5dBA for a minimum of 40% of the system horn units and install as needed to meet the Owner's needs.
4. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box.
5. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
6. Provide directional projector where noted on the Drawings.
7. Provide backbox and grille for fully recessed installations; 4 in. deep box maximum.
8. Horn for carbon monoxide alarm notification shall meet the requirements above but have a white finish color, have the word "ALERT" imprinted on the device and have a temporal Code 4 alarm.

B. Strobe Unit:

1. 24 volts DC with built-in Xenon Flasher; two watts maximum. Pulse duration shall be 0.2 seconds with maximum duty cycle of 40%. Illumination intensity shall be field selectable for 15/30/75/110 candela or 135/177/185 candela as applicable for the location. Output setting shall be 15 candela in corridors, 75 candela in general areas, 177 candela in sleeping areas or as indicated. Flash rate minimum 1 Hz, maximum 2 Hz. Units within building shall flash in synchronization.
2. Protruding pyramid shaped lexan lens with reflector and the word "FIRE" imprinted on the lens.
3. Rated life shall be a minimum of 500 hours of continuous operation.
4. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
5. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then

unit shall be surface mounted utilizing the manufacturers back box. Wall or ceiling mounted as noted on the Drawings.

6. Provide surface backbox for surface installation; 4 in. deep maximum.

7. Strobe for carbon monoxide alarm notification shall meet the requirements above but have a white finish color and have the word "ALERT" imprinted on the device.

C. Combination Horn-Strobe Units:

1. Unit shall be a combination of the horn and strobe units specified above in a single manufactured unit.

2.07 ADDRESSABLE CONTROL MODULE

A. The addressable control module shall have an individual system address, be supervised and control an output dry contact from indication from the FACP. This can be used to control or have an input to elevator controls, notification appliances, door holder circuits, fans systems, etc. as indicated. Modules shall be connected to the addressable loop(s).

B. The unit shall control an output relay (dry contact form C). The module shall mount in a 4 in. square, 2-1/8 in. deep electrical box.

C. The module shall contain an integral LED that shall flash each time the module is polled.

D. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device. Each unit shall have a separate address and be connected to the system addressable signaling circuit.

2.08 REMOTE ANNUNCIATOR

A. Wall mount within a flush box. Maximum depth of 4 in., stainless steel trim. Nominal dimensions of 4 in. x 12 in.

B. Annunciation shall be by two line by 40 character LCD display to provide system information and alarm/trouble description.

C. Unit power and control shall be from the FACP. Unit circuiting shall be supervised.

D. Provide trouble signal with audible buzzer, silencing switch and system reset. All pushbuttons shall be inoperable without keyswitch activated. Pushbuttons for alarm acknowledge, silence and alarm reset shall be standard on the front with a description. Shall include a minimum of four auxiliary switches/pushbuttons to be programmed as coordinated with the owner (possible options are door holder release override, manual alarm initiation, elevator capture bypass, etc.).

E. Tamper-resistant front panel screws.

2.09 MUNICIPAL TIE EQUIPMENT - LEASED TELEPHONE LINE SYSTEM

A. Provide complete system consisting of sending and receiving equipment.

B. Transmission shall be provided over telephone lines arranged by the Owner.

C. Sending reversing relay and associated equipment shall be contained within the Fire Alarm Central Processing Unit enclosure.

D. Sending equipment shall transmit telephone line trouble as well as fire alarm condition signal.

E. Provide all required receiving equipment at local fire department headquarters.

2.10 AUTOMATIC DIALER

A. Provide automatic tie to telephone line upon activation of the fire alarm system and transmission of prerecorded message. Provide two telephone lines from the building service individually routed to the FACP and terminated.

B. Ten minute digitally stored message capacity.

C. Provide automatic line seizure.

D. Provide automatic telephone dialing to a prearranged telephone line. System shall have standard pre-recorded message stored in the memory. Record and store custom message as indicated by the Owner or call station.

2.11 DIGITAL COMMUNICATOR

A. The digital fire communicator shall be installed in the FACP or mounted in a separate enclosure. The communicator shall be powered by 24 VDC from the FACP and shall report four (4) conditions - (2) alarm, (1) trouble and (1) supervisory. The unit shall have a built in auxiliary relay output which is programmable for alarm or trouble conditions, and shall be capable of sending a distinctive AC power failure report.

B. Install all wiring in accordance with manufacturer's recommendations. All wiring shall be completely tested as directed by the manufacturer, and a written test report submitted to them for approval. Their approval shall be obtained before connecting any devices. The system manufacturer, by their approval of the test report, shall assume all responsibility for all installed wiring.

C. The communicator shall have the following features: visual and audible trouble indications; supervised or unsupervised input channels, dual phone line interface with line seizure; local and remote programming and automatic 24-hour test.

D. The communicator shall be UL 864 listed and meet the requirements of NFPA 72 Chapter 4 for supervising station fire alarm systems.

2.12 CENTRAL STATION MONITORING

A. Make all arrangements for, and pay all costs for a UL listed central station monitoring service to monitor the fire alarm system through the digital communicator for a period of one (1) two (2) years.

2.13 BATTERY AND CHARGER

A. Standby power shall be provided through 24 volt DC battery and automatic charger.

B. Provide sealed lead-calcium batteries suitable for a minimum of 24 hours of battery standby. When the system is operating on the battery supply, a trouble condition shall be generated. When utility power is restored, the system shall revert back to 120 VAC supply without any operator action.

C. Provide cell reversal protection.

D. Battery life expectancy shall be ten (10) years minimum.

E. Charger shall be self-regulating, solid state, type, automatic with capability to fully charge the discharged battery within 48 hours.

F. Locate charger within the FACP enclosure. Locate batteries in FACP enclosure.

**PART 3 - EXECUTION**

3.01 INSTALLATION, EQUIPMENT

A. All installations shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of Work. Fire alarm installation shall be directed by a person who possesses a state license for installation of fire alarm systems. All equipment and components shall be installed in accordance with the manufacturer's recommendations.

B. System junction boxes and surface mounted device boxes shall be painted red.

C. All notification circuits shall originate from the FACP. Signal expander units shall not be used.

D. Provide all wiring to sprinkler flow switches, pressure switches, and alarm check valves, installed by others. Maintain supervisory circuitry to the switches. Use liquidtight conduit for the last 2 ft. - 0 in. of raceway at the switch.

E. Provide all wiring to post indicator valves, OS&Y valves and dry pipe sprinkler system maintenance air pressure switches, provided by others. Wire into the supervisory alarm portion of the fire alarm system.

F. Provide all wiring to the smoke dampers installed by others. Provide an addressable control module for each. Wire to the damper junction box with flexible conduit and wire; provide box or boxes as required. Install according to

NEC. Smoke dampers shall close when its associated smoke duct detector is in alarm, upon direction from the FACP or if the associated fan unit is not operating.

G. Provide all power supplies and wiring to smoke relief hatches and fire barriers provided by others. Smoke relief hatch or fire barrier shall operate only when its associated smoke detector is in alarm.

H. Provide all wiring to duct smoke detectors. Duct smoke detectors shall be mounted on the ventilating ductwork by others. All mounting arrangements, holes cut into ductwork, sealing of openings along with ceiling and access doors for the duct type detectors shall be provided by others. Provide duct detectors along with sampling tubes with end caps. Sequence smoke damper operation thirty seconds after its associated fan has been shut down.

I. Provide all wiring required for fan shutdown. Wire from the addressable control module for each fan to be shut down and provide wiring from the module to the fan control unit (starter, adjustable speed drive, etc.) Dry contact shall be wired ahead of all control functions for starters. Provide intermediate relay for control circuits beyond the rating of the control module.

J. Coordinate the municipal tie with the local Fire Department and comply with Fire Department requirements and regulations. Coordinate leased telephone line tie with Owner and Telephone Company.

K. Detection and initiating equipment shall be listed by NRTL and approved by FM.

L. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.

M. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.

N. Install wall mounted audio/visual signal devices at 80 in. AFF to center line. Where ceiling types are called for, verify ceiling type and mounting height in the field. Provide pendant-mounted devices as required for specified mounting height.

O. An auxiliary fire alarm relay used to control an emergency control device that provides control functions described in this specification shall be located within 3 ft. of the emergency control device and all wiring shall be supervised.

P. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise. All such Work shall be performed by an authorized representative of the manufacturer trained in such procedures.

Q. Provide circuiting from all indicated motor controls for indication if not operational and close any associated smoke dampers.

3.02 SYSTEM CIRCUITING

A. All wiring shall conform to the NEC and to NFPA-72, National Fire Alarm Code.

B. Install all wiring in accordance with manufacturer's recommendations taking into account loading, intended location, circuit length, spare capacity and voltage drop.

C. All wiring shall be copper and installed in a dedicated/segregated EMT conduit system.

D. Power circuits:

1. Provide the required quantity of 20 ampere, 120 volt circuits to the system with a minimum of one (1) for the FACP.
2. Circuit breakers serving fire alarm system equipment shall have a red handle lock to prevent from manual off operation. Directory shall be marked for the specific equipment served.

E. Provide minimum #18 AWG twisted shielded pair for addressable signal line circuits. Notification appliance circuits shall be#14AWG minimum. Conductor size shall meet or exceed the manufacturer recommendation and be within the voltage drop calculations.

F. Addressable signal line circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).

G. Notification appliance circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).

H. Notification circuits shall be segregated as indicated on the drawings and by individual floors as a minimum.

3.03 PROGRAMMING

A. Include in bid the cost to cover all system programming, including items particular to this project (such as custom zone descriptions, time delay settings, sensitivity settings, etc.) such that entire system is 100% complete and operating to the Owner's satisfaction. Coordinate all system programming with the Owner. Also, provide programming of the system a minimum of once during the warranty period to provide changes requested by the Owner.

3.04 SPARE EQUIPMENT

A. Provide the following spare equipment to the Owner. Deliver the equipment to the Owner designated location on the project site in original packaging.

B. Equipment to include:

1. Smoke detectors: 5% of each type used with a minimum of five (5).
2. Heat detectors: 5% of each type used with a minimum of five (5).
3. Addressable control modules: 2% of each type used with a minimum of two (2).

3.05 BUILDING RADIO SIGNAL SITE SURVEY

A. The contractor shall have a third party entity perform a radio signal site survey to determine the fire department radio signal strength throughout the project area. This shall be conducted at the end of construction and by a sub-contracted firm with methods acceptable to the local jurisdiction.

B. The survey shall be coordinated and in conjunction with the local fire department.

C. The survey shall meet the requirements of the Fire Code of New York State. Provide a report describing the survey methods used, pertinent requirements, measurements taken, areas where the signal strength is acceptable and recommendations for amplification/building antennas for areas where the signal strength is no suitable.

3.06 TESTING AND INSTRUCTION

A. The complete fire alarm system shall be fully tested after the installation is complete. Testing shall include all devices, FACP, annunciator panel, other panels, features and functions. Testing shall be witnessed by the owners representative and be in accordance with the NFPA and herein. Provide a testing report to the authority having jurisdiction and the Engineer as a submittal.

B. Provide a minimum of four (4) hours of instruction to the operating personnel designated by the Owner's Representative with regard to use and operation of the system. Provide up to three programming modifications.

C. Provide three (3) sets of keys to all panels, manual stations, etc., to the Owner's Representative.

D. Provide a copy of the system programming to the Owner on a CD/DVD disk or flash drive.

E. Provide to the Owner system Operation Manuals as specified, that shall include as a minimum:

1. Bill of Material.

2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.
3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.
4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting and control circuiting. Contact the Engineer for a copy of the project floor plans.
5. Typical Terminal Wiring Diagram for each type of device.
6. Terminal wiring Diagram for all Fire Alarm equipment.
7. Calculations including:
   a. Battery sizing calculations indicating total number of power devices, load associated with each type device and recommended battery capacity (AH).
   b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.
8. Instruction report starting when instruction was given and who was in attendance, signed by Owner's Representative.
9. A written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved.
10. Certificate of Completion as described in NFPA-72.
11. A two (2) year warranty in accordance with the Basic Requirements of these Specifications shall be provided for this system.

## 3.07 CO DETECTOR SIGNAGE

A. Coordinate with the Owner, install a permanent 8-1/2 in. and 11 in., two (2) color lamicoid sign at eye level in the vicinity of every CO alarm notification device indicating specific instructions to be followed, ex. "Do not enter room if an alarm is sounding".

END OF SECTION

**WARNING - THIS IS NOT SET UP FOR SMOKE EVAC SYSTEMS; HIGH RISES NOT APPLICABLE ON ALL PROJECTS.**

**System Outputs**

| System Inputs | Actuate Common Alarm Signal Indictor | Actuate Audible Alarm Signal | Actuate Common Supervisory Signal Indicator | Activate Audible Supervisory Signal | Actuate Common Trouble Signal Indicator | Activate Audible Trouble Signal | Indicate Zone or Device Description | Activate Notification Appliances | Display Change of Status on All Annunciators/Printers | Transmit Alarm Signal to Central Station | Transmit Supervisory Signal to Central Station | Transmit Trouble Signal to Central Station | Release Magnetically Held Doors | Recall Elevator to Recall Floor | Actuate Warning to Elevator Controls | Actuate Warning to Elevator Cabs | Activate Elevators Shunt Trip | Close All Related Smoke Dampers | Unlock All Exits and Control Doors | Shutdown Respective Air Handling Units (SA and RA) | Activate Floor Pressurization (High Rise Only) | Activate Stairwell Pressurization (High Rise Only) | Active Smoke Exhaust (High Rise Only) | Open Associated Smoke Hatch | Local Notification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fire Alarm System AC Power Failure | | | | | X | X | | | | | | X | | | | | | | | | | | | | |
| Fire Alarm System Low Battery | | | | | X | X | | | | | | X | | | | | | | | | | | | | |
| Open Circuit | | | | | X | X | | | | | | X | | | | | | | | | | | | | |
| Ground Fault | | | | | X | X | | | | | | X | | | | | | | | | | | | | |
| Circuit Short | | | | | X | X | | | | | | X | | | | | | | | | | | | | |
| Manual Pull Station Actuation | X | X | | | | | X | X | X | X | | | X | | | | | | X | | | | | | |
| Area Smoke Detectors | X | X | | | | | X | X | X | X | | | X | X | | | | X | X | | X | X | X | | |
| HVAC Air Duct Smoke Detector | X | X | | | | | X | | X | X | | | | | | | | X | | X | | | | | |
| Area Heat Detectors | X | X | | | | | X | X | X | X | | | X | X | | | | X | X | | X | X | X | | |
| Fire Suppression System Alarm | X | X | | | | | X | X | X | X | | | X | X | | | | X | X | | | | | | |
| Sprinkler Tamper Switch | | | X | X | | | X | | | | X | | | | | | | | | | | | | | |
| Sprinkler Water Flow in Building | X | X | | | | | X | | | X | | | X | X | | | | X | X | | | | | | |
| Sprinkler Water Flow in Elevator Equipment Room or Shaft | X | X | | | | | X | X | X | X | | | | | X | X | X | X | | | | | | | |
| Elevator Shaft Smoke Detector | X | X | | | | | X | X | X | X | | | | | | | | | | | | | | X | |

APPENDIX A
FIRE ALARM SYSTEM OPERATION/SEQUENCE MATRIX

| System Inputs | Actuate Common Alarm Signal Indictor | Actuate Audible Alarm Signal | Actuate Common Supervisory Signal Indicator | Activate Audible Supervisory Signal | Actuate Common Trouble Signal Indicator | Activate Audible Trouble Signal | Indicate Zone or Device Description | Activate Notification Appliances | Display Change of Status on All Annunciators/Printers | Transmit Alarm Signal to Central Station | Transmit Supervisory Signal to Central Station | Transmit Trouble Signal to Central Station | Release Magnetically Held Doors | Recall Elevator to Recall Floor | Actuate Warning to Elevator Controls | Actuate Warning to Elevator Cabs | Activate Elevators Shunt Trip | Close All Related Smoke Dampers | Unlock All Exits and Control Doors | Shutdown Respective Air Handling Units (SA and RA) | Activate Floor Pressurization (High Rise Only) | Activate Stairwell Pressurization (High Rise Only) | Active Smoke Exhaust (High Rise Only) | Open Associated Smoke Hatch | Local Notification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elevator Equipment Room Area Smoke Detector | X | X | | | | | X | X | X | X | | | X | X | | X | | X | X | | | | | | |
| Elevator Shaft and Equipment Room Heat Detectors | X | X | X | X | | | X | X | X | X | | | X | X | | X | X | X | X | | | | | | |
| Elevator Pit Sprinkler Flow | X | X | | | | | X | | | X | | | | X | X | X | X | | | | | | | | |
| Elevator Pit Heat Detector | X | X | | | | | X | X | | X | | | | X | X | X | X | | | | | | | | |
| Elevator Lobby Smoke Detectors | X | X | | | | | X | X | X | X | | | X | X | | | | X | X | | X | X | X | | |
| Elevator Lobby Recall Floor | X | X | | | | | X | X | X | X | | | X | X | | | | X | X | | X | X | X | | |
| Fire Pump Power Failure/Phase Reversal | | | X | X | | | X | | X | X | X | X | | | | | | | | | | | | | |
| Fire Pump Low Fuel | | | X | X | | | X | | X | X | X | | X | X | | | | X | X | | | | | | |
| Fire Pump Running | X | X | | | | | X | | X | X | | | X | X | | | | X | X | | | | | | |
| Jockey Pump Running | | | X | X | | | X | | X | | X | | | | | | | | | | | | | | |
| Fire Pump not in Automatic Mode | X | X | | | | | X | | | X | | | | | | | | | | | | | | | |
| Area of Refuge Two-Way Communication Status | X | X | | | | | X | | | X | | | | | | | | | | | | | | | |
| Smoke Detector Adjacent to Smoke Hatch | X | X | | | | | X | X | X | X | | | X | X | | | | | X | | | | | X | |
| AHU Off, Any Reason | | | | | | | | | | | | | | | | | | X | | | | | | | |
| CO Detection | | | X | X | | | X | | X | | X | | | | | | | | | | | | | | X |

SECTION 28 40 00

TANK GAUGING INSTRUMENTATION AND CONTROL

(ADD ALTERNATE 2)

## PART 1 - GENERAL

### 1.01 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, tools, and equipment, to install all instrumentation and controls associated with the Gasoline/Diesel AST and related work, as specified herein, and as required by the Contract Documents.

### 1.02 QUALITY ASSURANCE:

A. Installation of all systems shall be performed by a Contractor who possesses an Installer's License and is certified the equipment manufacturer. The Contractor shall have a minimum of five years of experience.

B. The Contractor shall purchase the systems from a manufacturer approved by the Engineer. The manufacturer shall maintain a service depot within 75 miles of the facility. The service depot must be capable of timely delivery of parts and service personnel for servicing the system at any time. The manufacturer shall furnish required supervision, as required by the Engineer for the installation of the systems and shall furnish an experienced installation and maintenance worker for the supervision of personnel in the initial operation and maintenance of the systems.

C. The Contractor shall install compatible components and shall perform all modifications necessary for the proper operation and guarantee of the equipment. The Engineer reserves the right to require the Contractor to make such tests, during the installation and upon the completion thereof, as may be necessary to demonstrate that the work and equipment, as installed, complies with the Contract Specifications and requirements provided herein. The Contractor shall provide all labor, instruments, and apparatus required for such tests. If any of the work or equipment fails to meet the Contract Requirements or to function properly, the defects shall be rectified at the Contractor's own expense by readjusting, or by removing and replacing the faulty work or equipment until, under test, the requirements are met. The Engineer reserves the right to check the Contractor's instruments or to furnish its own instruments.

### 1.03 REFERENCES:

A. All instrumentation and control equipment shall comply with the following standards and all other applicable federal, state, local and most recent Building Code requirements, including revisions to the date of Contract:

| | |
|---|---|
| NFPA | National Fire Protection Association |
| ANSI | American National Standards Institute |
| ASTM | American Society of Testing Materials |
| ASME | American Society of Mechanical Engineers |
| NEC | National Electric Code |
| ISA | Instrumentation Society of America |
| NEMA | National Electrical Manufacturers Association |
| IEEE | Institute of Electrical and Electronic Engineers |
| API | American Petroleum Institute |

1.04 SUBMITTALS: IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 03 30 00 SUBMITTALS, SUBMIT THE FOLLOWING:

A. Shop drawings:

1. Wiring and schematic diagrams certified by the manufacturer to meet NFPA/NEC explosion proof requirements and any other details required to demonstrate that the system has been coordinated and will function properly as a unit. Site specific, sealed electrical drawings shall be furnished by the manufacturer.

2. Equipment and instrument list, including size, input/output types, expected range of operation, utility requirements, and materials of construction. A Bill of Materials also shall be included and keyed to the drawings. The Bill of Materials shall provide sufficient information to determine compliance with the Contract Drawings and Specifications.

3. Drawings showing the proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of work, including clearances for maintenance and operation.

4. Manufacturers' descriptive and technical literature, including catalog cuts.

5. Legends for name plates.

6. Equipment certifications and test reports.

B. Spare Parts Data: Within thirty (30) days of Shop Drawing approval, the Contractor shall furnish spare parts data for each different item of material and equipment specified. Data shall include a complete list of parts and supplies, with current unit prices and a source of supply. A list of all special tools required for installation, maintenance or repair of equipment shall be provided.

C. At a minimum the contractor will supply the following spare parts and tools:

| | |
|---|---|
| cable seal kit | cable kit |
| cord grip | red plastic lens |
| sensor mounting kit | universal mounting kit |
| probe cap kit for AST | tie wraps |
| probe riser cap | probe riser cap tool |
| emergency alarm | emergency switch |
| sealing pack | |

D. The Contractor shall furnish those spare parts and special tools which are recommended by the manufacturers.

E. Operating and maintenance instructions shall be provided for each different type of control, instrument, and system.

1. Operating instructions outlining the procedures required for equipment and system start-up, operation, and shut-down. The instructions shall include the manufacturer's name, model number, service manual, parts list, and a brief description of all equipment and their basic operating features.

2. Maintenance instructions listing routine maintenance procedures, possible breakdown and repairs, and troubleshooting guide.

F. Performance Test Reports: Upon completion and testing of the installed system, test reports shall be submitted showing that all field tests are performed to adjust each component and that all field tests are performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of the controls.

1.05 MANUFACTURER'S SERVICES:

A. The Contractor shall provide the services of a manufacturer's engineering consultant who is experienced in the installation, adjustment, and operation of the instruments and controls to be provided, and who shall supervise the installation, adjustment, and testing of the equipment.

B. The leak detection/inventory control system shall include a minimum one-year warranty and one-year fuel management services contract for the entire system that includes on-site replacement of parts, programming, testing of system features, and a minimum of the following:

1. Consolidated monthly reports on all tanks, lines and sensors.
2. Remote monitoring for all sites installed or upgraded.
3. A tank test performance guarantee for all ASTs.
4. Alarm response 24 hours a day, 7 days a week.

a. Notifies detailed personnel according to alarm condition and type.

b. Archives alarm reports continuously.
c. Allow instant access to consolidated alarm history.
d. Allows protocol for each individual alarm.

C. The fuel management services contract shall be provided by the systems manufacturer who shall have provided these services for a minimum of one year. The services contract will include services 24 hours a day all seven days per week with employees assigned within 75 miles of the site.

1.06 FIELD TRAINING:

A. The Contractor shall provide a field training course for the Owner and its designated operating staff. Training shall be provided for a total of four (4) hours of normal working time and shall be completed prior to the system's final acceptance by the Owner. Field training shall cover all of the items contained in the operating and maintenance manuals.

PART 2 - PRODUCTS

2.01 GENERAL SYSTEM SPECIFICATIONS:

A. Description

1. A continuous monitoring and leak detection system shall meet the performance specifications and functions of the Veeder-Root Company TLS4b AST Monitoring system or approved equal.

2. The storage tank monitoring system shall meet all applicable standards and regulatory agency requirements including, but not limited to, the standards and requirements of the following:

a. American National Standards Institute (ANSI)
b. American Petroleum Institute (API)
c. American Society for Testing and Materials (ASTM)
d. Environmental Protection Agency (EPA)
e. National Bureau of Standards (NBS)
f. National Electrical Code (NEC)
g. National Fire Protection Agency (NFPA)
h. Underwriters Laboratories Inc. (UL)
i. Canadian Standards Association (CSA)
j. Canadian Underwriters Laboratories Inc. (cUL)
k. Federal Communications Commission (FCC)

3. The storage tank monitoring system shall meet all applicable standards to operate in a Class 1 Division 1 Group D hazardous location.

B. System Security

1. The system shall allow setup of users with different levels of security, limiting access to unauthorized personnel to areas such as Setup and Diagnostics. System Security will require login credentials for access to the GUI, Web- Enabled, and RS-232 communication. System Security will automatically log a user out after 15 minutes of inactivity.

2. The system shall have three predefined roles: Administrator, Operator, and Regulator with the following access permissions:

   a. Administrator: Able to edit console configuration, perform software upgrades, generate reports, and start various diagnostics tests. Also, able to create new roles and users.

   b. Operator: Able to view and generate reports and perform certain manual functions, like a manual delivery.

   c. Regulator: Able to print and review console reports.

3. The system shall have the ability to create custom roles, allowing the administrator to select access to: Diagnostics, Reports, Setup, System Status, and System Administration.

2.02 ENVIRONMENTAL COMPLIANCE SPECIFICATIONS:

A. In-Tank Leak Detection

1. <u>Static Leak Detection (SLD)</u>

   a. The system shall utilize Magnetostrictive probes with six thermistors for liquid level measurement, in-tank leak detection and temperature measurement.

   b. The tank gauge shall be capable of performing a static tank tightness test to an accuracy of 0.1 GPH with at least a 98% probability of detection [P (D)] and no more than 1% probability of false alarm [P (FA)].

   c. The system shall have the ability to automatically run a static leak test, by monitoring the activity of the submersible pump. Depending on the idle time between pumping cycles, the system will automatically run a 3.0 GPH test, a 0.2 GPH test or a 0.1 GPH test. Each successive test will start automatically upon completion of the previous test. If a dispensing transaction or a delivery takes place, the system will automatically disable the test until the next appropriate idle period.

d. The system shall be capable of performing a 0.2 GPH or 0.1 GPH test to start automatically or manually and have the ability to run a quick leak test. This quick static leak test will take one hour, and commence 30 minutes after the last dispensing cycle, or five hours from the last delivery, whichever is greater. The minimum time for a 0.2 GPH static test shall be two hours and three hours for a 0.1 GPH static leak test.

e. The system shall post a warning and or alarm after a specified number of days have passed (0-30) since the last leak test was run or successfully passed.

2. Continuous Statistical Leak Detection (CSLD)

a. The system shall have the ability to conduct automatic CSLD tests without the need to shut down tanks for scheduled test times.

b. The system, when operated in CSLD mode, shall be third-party certified for statistical leak detection in single tanks up to 45,000 gallons and 37,000 gallons on manifold tanks. The test shall meet or exceed U.S. EPA standards with a 99% probability of detecting a 0.2 GPH leak and less than a 0.1% probability of false alarm. It shall meet federal, state and local compliance requirements for monthly monitoring.

c. The system shall be capable of dynamically qualifying the idle time data and selecting the best available data to perform a 0.2 GPH tank tightness evaluation. During each idle period an evaluation will be performed and the data will be added to the database. The system shall employ the use of dynamic feedback variables in the algorithm to evaluate the noise factor patterns associated with a tank, thus tailoring the algorithms to each individual tank.

B. Interstitial Leak Detection

1. Dry Monitoring

a. The system shall be able to perform automatic, continuous leak sensing in the dry interstitial space (annulus) of a double-wall tank, to detect a breach in the inner or outer shell. The system shall differentiate between hydrocarbons and water, and provide an indication of a fuel alarm or a liquid alarm.

b. The system shall have the ability to sense the presence of hydrocarbons and/or liquid and provide an alarm for worst-case condition (fuel). The system shall have the ability to continuously monitor the integrity of the sensor for an open condition, alarm condition, or normal operating condition.

c. Provide monitoring sensors to monitor tank's interstitial space (one for each tank).

2.03 REPORTING:

A. Generation

1. The system shall have the ability to generate reports from the GUI, Web-enabled, or via a RS-232 command (display/computer format). These reports will provide the same information independent of how the report request is generated. The system shall have the ability to store up to three years' worth of report data.

2. Reports can be scheduled to auto generate on date and time and have selectable date range for data review.

B. Output

1. All reports shall be available from a network printer, fax, modem, email or from a polling computer. A four-line, twenty-character customer location header to identify the site must be user-programmable. The header must appear automatically on inventory status reports, leak detection reports and automatic delivery reports each time they are printed.

C. Alarm

1. The system shall have the capability to generate an Active Alarm Report, Alarm History Report and Priority/Non-Priority Report. The console shall continuously monitor all probes and sensors, reporting not only normal operating conditions, but also system malfunctions or failures.

2. System shall accept input from an external acknowledge switch to acknowledge the alarm and silence the buzzer.

3. System shall have the ability to print out the alarm when the alarm is generated and E-mail alarm conditions to designated personnel.

D. Environmental

1. The system shall provide the following reports related to Environmental Compliance.

   a. Combined Tank Test shall provide a report of both SLD and CSLD test results. This report will only show tests that have successfully passed.

   b. Sensor History shall provide reports anytime a sensor has gone into an alarm and when the alarm cleared. The report shall also indicate the type of alarm. The report shall report "Normal" if the sensor has never been in alarm.

   c. Sensor History provides proof of compliance to regulators. This report can be generated on a daily, weekly, or monthly basis or as programmed by the end-user.

d. Sensor Status shall report the current status of all enabled sensors.

E. Units of Measure

1. The system shall monitor inventory in U.S., Metric or Imperial units for up to four above ground and underground tanks; and produce a combination of automatic and manual inventory reports for each tank, which includes the following information:

   a. Tank identification
   b. Fuel volume / height
   c. Temperature-compensated fuel volume
   d. Ullage
   e. Water height / volume
   f. Fuel temperature
   g. Time and date

F. Inventory

1. The system shall provide an inventory history of up to 720 records per tank.

2. The system shall be able to monitor underground and above ground storage tanks in single or manifold configurations.

3. The system shall be able to monitor (measure) API listed products including, but not limited to motor fuels, LPG, methanol and alcohol blends. The system shall be able to measure density for gasoline and diesel.

4. The system shall have the ability to generate a power outage inventory report. This report shall track inventory levels before and after power outage, any variation in volume shall indicate tank activity during the outage.

5. The system shall have the ability to set User Ullage from 90% to 100% of Maximum Volume.

G. Delivery

1. The system shall automatically generate an inventory increase report (Delivery) when a delivery of product to a tank has taken place. The report shall include the time and date of the delivery, the starting volume in the tank, the ending volume in the tank, the starting temperature of the fuel, the ending temperature of the fuel, and the inventory increase amount. The system shall have the ability to generate a power outage delivery report in the event power is lost during a delivery. This report will be automatically generated once the power is restored.

2. The system shall have the ability to generate a ticketed delivery reports using the BIR data and customer's Bill of Lading.

3. The information shall be available in U.S., Metric or Imperial units. The system shall have the ability to store up to three years of inventory increase reports. The system shall provide an automatic delivery report, programmed to print from 1 to 99 minutes after a bulk delivery to a tank is complete.

H. Timed Sudden Loss

1. The system shall be able to detect sudden losses in the tanks when not dispensing and generate alarms when the threshold has been exceeded. Timed Sudden Loss shall not require pump sense and is programmable for seven individual time periods or shall be able to be manually started and stopped. Timed Sudden Loss shall be able to be reset once an alarm is posted.

2.04 SYSTEM PROGRAMMING:

A. Interface

1. The system shall be able to be programmed via the 7" color touch screen or using Web-Enabled (Remote Access).

2. The system shall have an Acknowledge switch for consoles without the touch screen.

B. Online Context Help

1. The system will provide an online context help to assist with programming. The system shall also have Table of Context search capabilities.

C. Setup Wizard

1. The system shall be able to be programmed using a Setup Wizard from either the touch screen or Web-Enabled. The Setup Wizard will navigate through a comprehensive routine to ensure all fields are properly configured.

D. Languages

1. The system will support the following languages: Arabic, Chinese, English, Finnish, French, German, Hebrew, Hindi, Italian, Korean, Portuguese, Polish, Russian, and Spanish.

E. Security

1. The system shall provide the use of a security code to prohibit unauthorized entry to the systems set-up parameters. The system security code shall be entered through the user interface or through the external communications interface. The security code shall have the capability of containing alpha or numeric characters.

F. Set-Up

1. The system will maintain programming and reports in the event of a power loss. The system will be connected to the DPW's computer network so that anyone that has access to the network, and has authorization, may view the system status and receive alarm condition email alerts.

2. Set-up parameters shall include but not limited to the following:

   a. Automatic Events
   b. Communication
   c. Custom Alarms
   d. Date and Time
   e. Delivery
   f. Devices
   g. Display
   h. Headers
   i. Inventory
   j. Overview
   k. Printers
   l. System
   m. Tank
   n. Tank Chart

G. Email

1. The system shall have the ability to send emails using SMTP protocol in response to any console alarm or at a pre-programmed time.

2. The system shall store email contacts in a system address book.

3. The Contractor shall connect the tank monitoring system to the Owner's server so that it can be accessed by the Owner's employees at desktop computers and so email notifications of alarm conditions can be received.

H. Backup

1. The system shall have the ability to perform database backups and restore via a USB thumb drive.

I. Software Upgrades

1. <u>Remote Software Download</u>

a. The system shall have the ability to perform Remote Software Downloads, where new software is automatically downloaded to the system and stored until activated. Activation shall complete the Software Upgrade process.

2. Thumb Drive Download

a. The system shall have the ability to perform Software Upgrades, where new software is downloaded and activated via a thumb drive to the system. The Owner shall also be able to download the data from the system locally using a thumb drive.

J. Custom Alarms

1. The system shall allow all system alarms to be programmed with a custom message up to 19 characters long. Each Custom Alarm shall have the ability to activate or suppress the console alarm beeper, LED indicators, and be displayed on the GUI and in the Alarm Reports.

K. Favorites

1. The system shall allow commonly used GUI screens to be saved under the Favorite's icon for quick and easy navigation. The system shall allow for editing and deleting of saved locations in Favorites.

2.05 DIAGNOSTICS:

A. All diagnostic information shall be generated by the system itself. The system shall not allow the user to change or enter diagnostic information in any way, except for Density Offset Diagnostic. The system will provide an intuitive online help to assist with diagnostics. The following diagnostic information shall be included in the system:

1. Boot-up

a. The system shall include built-in Boot-up diagnostics, which will display where in the sequence the console is currently at.

2. System

a. System Diagnostics shall include: Module, RS-232, and power reset history.

b. Module Diagnostics shall display the hardware configuration to include board serial number and firmware revision.

c. RS-232 Communication monitoring to include bytes transmitted/ received, parity errors, overruns, and framing errors.

d. Power Reset history will monitor when the console was powered down and up.

3. Probe

   a. Probe diagnostics shall include probe type, serial number, probe length, factory calibrations, probe options, and communication status.

4. Tank Test

   a. Tank Test shall include test results for both SLD and CSLD.

      1) <u>SLD</u>

         I. SLD diagnostics shall include the following: In-Progress, Last Test, and History

            i. In Progress shall display current test status, test type, test result, start time, start volume, leak rate, and threshold.
            ii. Last Test shall display the start date and time, test results and reason if the test did not pass for the previous SLD test.
            iii. History shall display all previous test results with start date and time, test results, duration, leak rate, tank volume, and %volume.
         II. SLD diagnostics shall include the ability to perform a manual tank test.

      2) <u>CSLD</u>

         I. CSLD diagnostics shall include Test Status, Rate Test, Rate Table, and CSLD State Changes.

            i. Test Status shall display the current status of the CSLD test and how long the test has been in the current status.
            ii. The Rate Test shall display the overall status of the CSLD tank test based on an evaluation of all CSLD test results stored in the Rate Table. This diagnostic shall include compensated and uncompensated leak rate, total test time, average volume during tests, total count of test records and count of acceptable test records.
            iii. Rate table shall store the previous 28 days or 80 test results. The rate table shall display the date and time of the test, leak rate, temperature readings of the fuel and ambient air in the tank, the evaporation rate in the tank, the volume of the last delivery and test interval.
            iv. Monthly shall display any change of state of the status of CSLD. Change of state shall include a failed test, warning, passed test, no data, increase or no idle data.

5. Manual Calibration

    a. The system shall have the ability to perform a manual tank calibration by either using a meter drop or meter dispense method, where fuel is either delivered or dispensed from the tank in a controlled measured amounts.

6. Sensor

    a. Sensor diagnostics shall display the sensor type, category, and sensor status.

2.06 PRODUCT SPECIFICATIONS/CAPACITIES:

A. Console

1. The console shall be of a modular design that allows for the installation and expansion of console hardware and additional optional features in the future. The console shall support up to twelve intrinsically safe wiring ports, two high-power dry contacts, one low voltage external input and up to three communication devices (five ports).

2. The console shall be equipped with 7-inch Full WVGA LCD touch screen display with an aspect ratio of 16:9, for on-site viewing of information, programming, operating and reporting functions. The touch screen shall be self-calibrating.

3. The front panel shall have three indicators to provide a visual indication of power on, warning and alarm conditions along with an internal audible alarm.
4. The console shall be capable of printing to a USB or network printer. Reports shall be printed in rows/columns format.

5. The console shall be equipped with the ability to communicate directly with an external POS terminal, printing device or PC. The system shall also have the ability to communicate with a remote device via serial, telephone lines, satellite or Ethernet.

6. The system shall store console setup and compliance data in non-volatile memory and have a battery backup for data storage in volatile memory.

7. The console shall be wall mounted using internal mounting holes and be equipped with four 3/4” to 1” conduit knockouts on the top and the bottom of the monitor for conduit entry into the monitor. One conduit entry (top and bottom) shall be designed for access to the universal module.

8. The overall dimensions shall be 8” X 13” X 3.5”

9. The console shall have an internal quick-disconnect connector for 120/240 VAC wiring to the console for ease of installation, service and troubleshooting.

10. The console shall have an operational temperature range of 32° F (0° C) to 109° F (40° C) and shall be mounted in an area protected from severe vibrations, humidity, rain, and other conditions that could harm computerized electronic equipment.

11. The overfill alarm with acknowledgment switch shall be the audible horn and flashing light type. The overfill alarm shall be supplied with an alarm acknowledgement switch, and shall be weather proof for outdoor use. Alarm electronics shall be capable of operating from -40 degrees F. The alarm and acknowledgement switch shall be as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.

12. Remote alarms shall also be provided as indicated on the drawings

13. Two tank stick gauges shall be provided to manually monitor each tank (one per compartment).

B. Modules

1. The tank monitoring system shall incorporate a modular design to allow the factory installation of system features to meet specific application requirements, as well as field installation/modification of features at a later date to meet changing business, environmental compliance or regulatory requirements.

2. Universal Sensor Input Output Module (USMIO)

   a. Shall support probes and sensors up to:

      1) Twelve two-wire; six three-wire inputs.

   b. Shall support two dry contact output relays

   c. Shall support one low voltage inputs (<=12Vdc)

3. The system shall have the ability to contain up to five modules. The modules shall consist of standard communication and optional communication modules.

4. Standard Communication Modules shall include:

   a. Ethernet interface module: provides connectivity to local and wide area networks

   b. Dual Ethernet interface module: provides connectivity to local and wide area networks (LAN/WAN). Each interface is a separate Ethernet connection providing two distinct networks.

   c. Dual USB interface module: supports USB thumb drive

d. RS-232 dual interface module: provides two 9-pin D-connectors for data transmission to POS terminal or computer. Supports RS-232, satellite, Electronic Dispenser Interface Module (EDIM).

e. Optional Communication Modules shall include (Each system can accept up to two optional modules.):

f. Dual Ethernet interface module: provides connectivity to local and wide area networks (LAN/WAN). This interface is a separate Ethernet connection providing two distinct networks.

g. Current Loop Dispenser Interface Module (CDIM)

C. Manufacturer's Support/Field Service

1. The manufacturer shall provide technical phone support available to customers from 8:00 a.m. to 7:00 p.m. EST, Monday thru Friday.

2. The manufacturer shall maintain a nationwide field service staff to provide on-site customer support and training, as well as overseeing installation of tank monitoring system by installation contractor. The distributor/contractor field service representative shall be available for on-site training of company maintenance personnel on installation, programming and troubleshooting of tank monitoring system.

3. The manufacturer shall supply a formal list of all Authorized Distributors and Service Contractors for sales, installation, training and support.

4. The manufacturer shall require and provide mandatory certification training for all of its authorized distributors and service contractors/installers. The certification program shall consist of two certification levels covering installation, setup/operation and service/troubleshooting of the manufacturer's ATG monitoring systems. The manufacturer shall offer re-certification training to keep contractors/installers current with updated information.

D. Manuals

1. The manufacturer shall supply product documentation that addresses the following categories as additional support:

a. Site preparation and installation instructions
b. System setup instructions (via on-line help)
c. System operating instructions (via on-line help)
d. Individual sensor installation instructions
e. Probe installation instructions
f. Individual module installation instructions
g. Product data sheets

h. Troubleshooting and repair manuals
i. Wiring diagrams which include the following:

1) Identification of all devices and equipment terminals, and all external connection terminal blocks.
2) All external wiring connections with approved wire colors and circuit designations.
3) Serial communications manuals

E. System Warranty

1. The tank monitoring system shall be warrantied for a period of one year from date of Substantial Completion. The warranty is to include parts and labor, with all warranty work performed on site by an authorized manufacturer's representative.

F. Warranty Registration and Checkout Form (WRACO)

1. The manufacturer shall require that all ATG monitoring systems be started up by an authorized distributor. The startup shall consist of installation checkout, operation checkout and customer training on use of the equipment.

2. The manufacturer shall supply a WRACO to properly document the site information.

a. Installation location
b. Installer
c. Equipment identification
d. Tank information
e. Leak detector information
f. Start-up distributor information
g. Customer approval

3. Upon receipt of the WRACO, the manufacturer will initiate the system warranty and input the data into a site database.
4. The manufacturer shall offer Authorized Distributors pre-selected parts kits to service AST monitoring systems.

5. Delivery: the manufacturer shall have the ability to ship tank monitoring systems in three (3) working days from the time that an order is entered into the computerized system to the ship date.

6. ISO-9000: the manufacturer shall maintain an ISO-9001 rating ensuring quality management of design, manufacturing, training and technical documentation.

2.07 LEAK DETECTION AND INVENTORY CONTROL SYSTEM:

1. One (1) Magnetostrictive technology type, stainless steel inventory control and in-tank leak testing probe assembly as manufactured by Veeder Root HGP MAG Plus probe part number 846391-399. (one required per AST compartment).

2. One (1) annular space liquid sensing probes for interstitial space (per double-wall tank)

3. The annular space liquid sensing probe shall be capable of detecting liquids in the interstitial space between tank walls. The probe shall meet NEC, NFPA, and UL requirements for hazardous locations. Probe electronics shall be capable of operating from -20 degrees Celsius to +70 degrees Celsius. Annular space sensor shall be series 7943 interstitial Sensor for Steel tanks, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal. Controller shall be equipped with Eight-Input Type A Sensor Interface Module, Model No. 329956-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, OPW, Franklin Fueling or approved equal.

Third-Party Certification: the manufacturer shall supply third-party documentation for all products, certifying that performance meets or exceeds EPA requirements.

PART 3 - EXECUTION

3.01 GENERAL:

A. Installation of all equipment shall be in accordance with building codes, and the NFPA, NEC, and NEMA codes. The Contractor shall furnish and install all required conduit sealing fittings, explosion proof accessories, and NEMA Type 7 enclosures where indicated on the Contract Drawings, or where required by Code, or both.

B. The locations shown for instrumentation and control equipment on the Contract Drawings are approximate. The Contractor shall locate the new TLS-4i controller in the Directors office, as indicated on the Drawings. All power and control wiring and connections not specifically indicated on the Contract Drawings, but required for the proper operation of equipment shall be made by the Contractor in accordance with these Specifications. All electrical control and instrumentation equipment installed in Class 1 hazardous locations shall be installed in NEMA Type 7 enclosures. Conduits and wire ways leading to and from these areas shall be provided with sealing fittings. All non-conducting metal parts of switches and controls shall be rust-proofed by galvanizing, cadmium plating, baked enamel or by the use of a non-corroding metal. Springs, wherever used, shall be a phosphor bronze.

C. Each leak detection inventory control system shall be installed, programmed and adjusted in accordance with the manufacturer's instructions so that all components function properly. Each overfill alarm and alarm acknowledgement switch shall be

programmed and adjusted so that the alarm is activated at 90 percent of the tank capacity, unless noted otherwise.

3.02 TESTING:

A. General: All equipment (hardware and software) shall be factory and field tested to demonstrate that it provides the specified functions.

B. The factory and onsite test procedures shall be submitted to the Engineer for approval prior to starting the actual tests.

C. The onsite testing shall include checking of cables, testing of system subassemblies and checking of connections for each component and for the entire instrumentation and control system.

D. The Contractor shall notify the Engineer in writing that he is ready and desires to start the on-site system testing. The Engineer will authorize start of the testing at a mutually-agreed starting date.

E. Shop Testing: All activating devices, instruments and assemblies furnished under this item shall be set up in the shop of the manufacturer and tested over the full range of the equipment. The equipment shall satisfactorily perform all the functions within the requirements of the Specifications.

F. Field Testing: All instruments and systems shall be field tested to ensure conformance with the Specifications. Control systems shall receive dynamic loop tests which shall conform to the intent of ANSI: MC4.1 (ISA-S26). The control systems and equipment shall include provisions for such testing.

G. Input signals for equipment control shall be simulated for at least five signal values from 0 to 100 percent signal, with corresponding equipment response to be manually recorded, and adjustments made as required. Output signals from the equipment shall be read for at least five signal values from 0 to 100 percent of the meaningful process values, and adjustments shall be made as required.

H. All instruments used for control functions shall be tested with the final elements in the circuit in addition to simulated control methods. The Contractor shall adjust instruments and/or final elements to obtain the best working conditions for a dynamic system. The Specifications and Drawings show the general intent of the work only and not all system components are specified. The Contractor shall provide all materials, equipment, and labor needed to provide a complete and operable and code compliant permitted system, and in accordance with manufacturer recommendations. All components of the system shall be explosion proof as needed.

END OF SECTION

# SECTION 31 01 01

# SITE RESTORATION

## PART 1 - GENERAL

### 1.1 QUALITY ASSURANCE

A. Provide prepackaged seed readily available to the public with quality and purity equal to product of O.M. Scotts and Son, Marysville, OH 43041. On-the-job or made-to-order mixes will not be accepted.

### 1.2 DELIVERY STORAGE AND HANDLING

A. Deliver fertilizer in manufacturer's standard size bags or cartons showing weight, analysis, and the name of the manufacturer. Store as approved by Owner's Representative.

B. Store all seed at the site in a cool dry place as approved by the Owner's Representative. Replace any seed damaged during storage.

### 1.3 SCHEDULING

A. Time For Seeding: Optimum period to sow permanent grass seed is generally between April 1st and May 15th or between August 15th and October 1st. Schedule application for when weather conditions permit or as Directed.

1. Provide temporary seed and mulch when final grading is complete while waiting for optimal seeding period.
2. Provide temporary seed and mulch for temporary cover on disturbed ground not to be worked on for more than 7 days.
3. Provide temporary seed and mulch on disturbed earth prior to temporary shutdown of construction.

## PART 2 - PRODUCTS

### 2.1 TOPSOIL

A. Provide topsoil conforming to the following:

1. Original loam topsoil, well drained homogeneous texture and of uniform grade, without the admixture of subsoil material and

entirely free of dense material, hardpan, sod, or any other objectionable foreign material.

2. Containing not less than 4 percent nor more than 20 percent organic matter in that portion of a sample passing a 1/4 inch sieve when determined by the wet combustion method on a sample dried at 105 degrees C.
3. Containing a Ph value within the range of 4.5 to 7 on that portion of the sample that passes a 1/4 inch sieve.
4. Containing the following gradations:

| SIEVE DESIGNATION | PERCENT PASSING |
|---|---|
| 1 inch | 100 |
| 1/4 inch | 97 - 100 |
| No. 200 | 20 - 65 (of the 1/4 inch sieve) |

2.2 FERTILIZER

A. Fertilizer: Mixed commercial fertilizers shall contain total nitrogen, available phosphoric acid and soluble potash in the ratio of 10-6-4 (50% N/UF). 50% of total nitrogen shall be derived from ureaform furnishing a minimum of 3.5% water insoluble nitrogen (3.5% WIN). The balance of the nitrogen shall be present as methylene urea, water-soluble urea, nitrate and ammoniacal compounds.

B. Other fertilizers meeting DOT Specification Section 713-03 Fertilizer can be used.

2.3 SEED

A. Furnish fresh, clean, new-crop seed mixed in the proportions specified for species and variety, and conforming to Federal and State Standards.

B. Acceptable material in a seed mixture other than pure live seed consists of nonviable seed, chaff, hulls, live seed of crop plants and inert matter. The percentage of weed seed shall not exceed 0.1 percent by weight.

C. All seed will be rejected if the label indicates any noxious weed seeds.

D. Provide seed mixture equal to Scotts Pure Premium Sun and Shade North Grass Seed Mixture, comprised of the following:

| SEED MIXTURE | | | |
|---|---|---|---|
| AMOUNT BY WEIGHT IN MIXTURE | SPECIES OR VARIETY * | PERCENTAGE | |
| | | PURITY | GERMINATION |
| 30 PERCENT | FENWAY RED FESCUE | 97 PERCENT | 80 PERCENT |
| 30 PERCENT | ABBEY KENTUCKY BLUEGRASS BLEND | 95 PERCENT | 80 PERCENT |
| 20 PERCENT | DEVINE PERENNIAL RYE | 98 PERCENT | 85 PERCENT |
| 20 PERCENT | ENCHANTED PERENNIAL RYE | 98 PERCENT | 85 PERCENT |
| 100 PERCENT | | | |

*Variety may be altered depending on availability of seed from manufacturer.

2.4 MULCH

A. Hydroseed Application: Do all slurry preparation at the job site:

1. Water, mulch, fertilizer, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
2. Seed shall be added last and shall be discharged within 2 hours. Loads held over 2 hours will be recharged with ½ the seed rate before application.
3. Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.

B. HydroSeeding Application: One Step Hydroseed

| Lbs/Ac | Material |
|---|---|
| 2,000 lbs | 100% Cellulose or Wood Fiber |
| 80 lbs | Fertilizer (3.04 Fertilizer 10-6-4) |
| 16 lbs | Seed as per section (2.02 Seed) |

PART 3 - EXECUTION

3.1 GRADING

A. Rough Grading: Trim and grade lawn areas within the Contract Limit to a level of 4 inches below the finish grades indicated unless otherwise

specified herein or where greater depths are indicated. Provide smooth uniform transition to adjacent areas.

B. Finish Grading: Finish surfaces free from irregular surface changes, and as follows:

1. Grassed Areas: Finish areas to receive topsoil to within 1 inch above or below the required subgrade surface elevations.

3.2 SPREADING TOPSOIL

A. Perform topsoil spreading operations only during dry weather.

B. To insure a proper bond with the topsoil, harrow or otherwise loosen the subgrade to a depth of 3 inches before spreading topsoil.

C. Spread topsoil directly upon prepared subgrade to a minimum depth measuring 4 inches after natural settlement in areas to be seeded. Smooth out unsightly variations, bumps, ridges, and depressions that will hold water. Remove stones, litter, or other objectionable material. Finished surfaces shall conform to the contour lines and elevations indicated on the drawings or fixed by the Owner's Representative.

3.3 PREPARATION FOR SEEDING

A. Seed Bed: Scarify soil to a depth of 2 inches in compacted areas. Smooth out unsightly variations, bumps, ridges, and depressions that will hold water. Remove stones, litter, or other objectionable material.

3.4 FERTILIZING

A. Apply 10-6-4 fertilizer evenly at the rate of 40 pounds per 1000 sq ft.

3.5 SEEDING

A. Assume all risks when seed is sowed before approval of seed analysis.

B. Do not seed when the wind velocity exceeds 5 miles per hour.

C. Application Rate: 8 pounds per 1000 sq ft.

D. Dry Application: Sow seed evenly by hand or seed spreader on dry or moderately dry soil.

E. Wet Application: Refer to Hydroseeding Application.

3.6 MULCHING

A. Dry Application: Within 3 days after seeding, cover the seeded areas with a uniform blanket of straw mulch at the rate of 50 pounds per 1000 sq ft of seeded area.

B. Wet Application: All hydroseed applications are to be applied in a sweeping motion to form a uniform application and form a mat at the specified rates.

1. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at contractor's expense.
2. Reseeding: After "Final Acceptance", reseeding will be done at the request of the owner and shall be considered extra.

3.7 LAWN ESTABLISHMENT

A. Maintain the grass at heights between 2-1/2 inches and 3-1/2 inches and include a minimum of 2 mowings.

B. Water and protect all seeded areas until final acceptance of the lawn.

3.8 IRRIGATION SYSTEM MODIFICATIONS

A. Adjust irrigation system sprays and rotors within lawn areas to provide full head to head coverage.

B. Replace spray and rotor heads removed during demolition phase with in-kind make/model and nozzle type.

3.9 FINAL ACCEPTANCE

A. Final acceptance of seeded areas will be granted when a uniform stand of acceptable grass is obtained, with a minimum of 95 percent coverage. Portions of the seeded areas may be accepted at various times at the discretion of the Owner's Representative.

B. Unacceptable seeded areas, dry application: Reseed as specified and fertilized at one-half the specified rate.

C. Once accepted, the State will assume all maintenance responsibilities.

END OF SECTION 31 01 01

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# SECTION 31 11 00

# CLEARING AND GRUBBING

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED: Under this section the Contractor shall perform all clearing and grubbing required within the area to be occupied by the work as specified and as indicated.

1.3 RELATED SECTIONS

Section 31 22 13: Rough Grading.
Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 33 40 00: Storm Sewer Systems.

## PART 2 - PRODUCTS (Not used)

## PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING: Areas to be cleared and grubbed as shown on the plans, shall be cleared of all trees, stumps, roots, brush, weeds, shrubs and all other objectionable materials except those trees and shrubs as are specified or as required to be left in place. All such materials removed in the clearing of the area shall be completely removed from the site of the work. Trees and shrubs within the area which are to be left in place shall be adequately protected from damage, and excavated or piled materials shall not be deposited around them unless they are properly protected.

3.2 BACKFILLING: Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted.

3.3 DISPOSAL OF MATERIAL: Cleared materials and debris shall be removed from the site and disposed of at locations off the project site. The Contractor shall make all necessary arrangements for obtaining suitable disposal locations and the cost involved shall be included in the amount bid.

END OF SECTION 31 11 00

# SECTION 31 11 11

# DEMOLITION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY OF WORK

A. Specifically included without limiting the generality of drawings and specifications are:

1. Selective Demolition.

### 1.3 SELECTIVE DEMOLITION

A. Removal of all existing components and construction where shown, implied, and/or required to execute the reconstruction.

B. Removal and storage on site of all items/materials which at the Owner's direction, are to remain property of the Owner. All other items/materials are to be deemed demolition refuse.

C. Removal of all abandoned services and utilities within the work area.

D. Remove and legally dispose of all demolition refuse from the Project Site.

E. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

F. Protection of all existing services and utilities which are to remain functioning and in use during the construction period. Provide temporary services as required until all new systems are operational.

G. Disconnect and remove all project abandoned, or previously abandoned utility service connectors in accordance with regulations of authorities concerned.

H. Demolition and complete removal of existing system(s) unless otherwise noted.

I. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from the

Owner. Provide alternate routes around closed or obstructed traffic ways as required by the Owner.

J. Protect all site utilities at demolition work and placement of new work.

K. Bury NO demolition refuse on Site.

1.4 CONTROL DEVICES

A. Furnish and install construction fencing, dust and noise control barriers, etc. as required. Conduct selective demolition work in manner that will minimize need for disruption of Adjacent Neighbor's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will impact Owner's use of site.

1. Provide temporary sheeting, shoring, bracing as required to protect and support adjacent elements which remain.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 EXECUTION OF THE WORK

A. Perform all work in strict accordance with all applicable Codes, Laws, and Ordinances having jurisdiction over the Work and specifically in accordance with the following to the extent that such provisions are not in conflict with applicable local laws.

1. NYS Workmen's Compensation Law.
2. Rules of the Workmen's Compensation Board of the State of New York.
3. Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, Inc.
4. New York State Uniform Fire Prevention and Building Code.
5. Industrial Code Rule 23, Protection of Persons Employed in Construction and Demolition Work, State of New York, Department of Labor.
6. New York State Labor Law.

B. Submit a coordination Schedule for Shut-off, capping, removal, and continuation of any utility services.

1. Protection of Persons and traffic.

a. Ensure safe passage of pedestrians and vehicular traffic around areas of removal.
b. Conduct operations in a manner to prevent injury to persons or property.

c. Erect temporary passageways as required or directed by authorities having jurisdiction.

2. Avoid overloading portions of the existing structure with demolition debris, new materials, and/or equipment.
3. All materials resulting from the removal operation shall become the property of the Contractor except that identified or required to remain the property of the Owner.
4. All salvage and debris resulting from the demolition operations shall be immediately removed from the site and shall not be stored or permitted to accumulate or be sold at the site.
5. The Contractor shall comply with the applicable laws and ordinances governing the disposal of materials, debris, rubbish and trash off the project site, and shall commit no trespass on public or private property in any operation hereto or connected with this Contract.
6. No burning shall be permitted on the Project Site.
7. All uncharted conduits, mains, lines, etc. encountered in the project shall be taken care of properly and safely by the Contractor, who upon encountering them, shall notify the Owner of the findings and arrangements made for modification necessary as not to interfere with the work.
8. Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

## 3.2 DUST CONTROL

A. The Contractor shall be responsible for providing all the necessary precautions and measures to prevent and control the spread of dust during all phases of this project. These measures shall be implemented as required and as required by the Architect/Engineer throughout construction.

## 3.3 NOISE CONTROL

A. All operations shall be conducted as quietly as reasonably possible.

B. Personnel shall be instructed to avoid unnecessary noise and reminder signs shall be posted conspicuously.

C. Before starting any work that involves unavoidable noise, the Contractor shall notify the Architect/Engineer and Owner in writing sufficiently in advance to allow for special preparation, if any are possible.

D. Whenever persons are subjected to sound exceeding those listed on OSHA Standards table; feasible administrative or engineering controls shall be utilized.

E. Sound levels shall be measured on the A-scale of a standard sound level meter at low response. Genuine loss of hearing can result if a person is repeatedly exposed to levels greater than 85-90 dba during the workday.

## 3.4 CLEANUP

A. On completion of the work, the Contractor shall remove all temporary construction no longer needed, equipment, salvaged materials, trash and debris of all kinds and shall leave the area in a finished condition.

END OF SECTION 31 11 11

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# SECTION 31 22 13

# ROUGH GRADING

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Cutting, filling and compacting to establish subgrade for:

1. Pavements.
2. Lawns and landscape areas.

B. Compaction of embankments.

C. Disposal of unsuitable material.

D. Disposal of excess material.

E. Install grade stakes at 50-ft o.c. (or less) grid pattern to ensure all grades comply with allowable tolerances. This is true for subgrades and finished grades.

1.3 RELATED SECTIONS

Section 02 30 00: Soil Testing Services.
Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 32 10 00: Roadway and Miscellaneous Subbase.
Section 32 91 13: Soil Preparation and Soil Mixes.
Section 32 92 00: Lawns.
Section 33 40 00: Storm Sewer Systems.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies.

1. Comply with requirements of:

a. OSHA.
b. New York State Department of Labor.
c. U.S. Army Corps of Engineers
d. Other agencies with jurisdiction.

2. Obtain all permits required for the completion of the project.

B. Testing Laboratory Requirements:

1. Obtain a testing laboratory to perform soil testing and inspection for quality control during rough grading operations.
2. Before commencing work, obtain approval from Owner and Engineer of:

   a. Testing laboratory.
   b. Testing schedule.

C. Reference Standards:

1. NYSDOT Specs.
2. ASTM.

D. Allowable Tolerances:

1. Subgrades for areas other than roadways and miscellaneous surfaces should be:

   a. Graded parallel to finished grade.
   b. Within one inch of required grade.
   c. Without depressions which hold water.

1.5 SUBMITTALS

A. Test Requirements:

1. Testing laboratory.
2. Testing schedule.
3. Gradation test reports: For all materials specified in this section.
4. Optimum moisture and maximum density:

   a. Structural Fill.
   b. Native, on-site general fill.

5. Field density test reports.

B. Manufacturer's Data:

1. Geotextile.
2. Compaction equipment.
3. All Products.

1.6 PROJECT CONDITIONS

A. Notify:

1. UFPO at 1-800-962-7962 not less than 72 hours prior to starting rough grading for location of underground utilities such as gas, telephone, electric lines, etc.
2. Other private and public utilities in the work area.
3. Engineer and Construction Manager.

    a. At least 24 hours prior to commencing rough grading.
    b. When rough grading has established final subgrade elevations.
    c. When unsuitable material is encountered at required subgrades.
    d. When unauthorized excavations have taken place.
    e. When rock is encountered.
    f. When suitable subgrades become unsuitable due to lack of dewatering.
    g. When uncharted, unidentified, incorrectly charted or incorrectly located underground utilities are encountered.

B. Existing Conditions:

1. Data regarding subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings and test pits. It is expressly understood that the Owner or Engineer will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for convenience of Contractor.
2. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
3. Do not interrupt existing utilities servicing facilities occupied and used by Owner and others except when permitted in writing, and then only after acceptable temporary utility services have been provided, or permission to interrupt service is granted by utility authority. Provide minimum of 48 hour notice to utility company, and receive written notice to proceed before interrupting any utility.

C. Environmental Conditions:

1. Do not commence rough grading if ground is frozen, muddy or covered with snow.
2. Do not commence or continue rough grading when precipitation is falling.
3. Protect established subgrades against freezing when atmospheric temperature is less than 35° F.
4. Do not place embankment on frozen subgrade.

## 1.7 SEQUENCING AND SCHEDULING

A. Do not commence rough grading until:

1. Site preparation is complete within the Contract Limit Line.
2. Site preparation is complete within substantial portions of the Project as approved by the Engineer.
3. Adequate grade stakes have been established to guide work as required by the

Engineer.

4. All protective measures are in place.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Select Fill: Conforming to DOT Specs, Item 203.06 specified in Section 203-2.02B, sound, durable sand, gravel, stone or blends of these materials, free from organic material, other deleterious material and frozen sections. Material furnished shall have the following gradation:

| SIEVE SIZE | PERCENT PASSING BY WEIGHT |
|---|---|
| 4 inch | 100 |
| No. 40 | 0 - 70 |
| No. 200* | 0 - 15 |

*Fines passing No. 200 shall be non-plastic.

B. Select Granular Subgrade: Conforming to DOT Specs, Item 203.20, specified in Section 203.2.02E.

1. Well-graded rock may be used. Particles should not exceed 12 inches in greatest dimension nor 2/3 of the loose lift thickness, whichever is less.
2. All materials, other than well graded rock, furnished under this item shall have no particles greater than 6 inches in maximum dimension. Of the portion passing the 4 inch square sieve, the material shall have the following gradation:

| SIEVE SIZE | PERCENT PASSING BY WEIGHT |
|---|---|
| 1/4 inch | 30 - 100 |
| No. 40 | 0 - 50 |
| No. 200 | 0 - 10 |

Where the Owner elects to test for this requirement, a material with a Magnesium Sulfate Soundness Loss exceeding 35 percent will be rejected.

3. Materials should be free from organic materials, other deleterious material and frozen sections.

C. Native Material: Subsoils found at the site may be used as fill that will not support structures, roadways, artificial turf field or miscellaneous surfaces, as approved by Engineer.

1. Saturated native materials should be stockpiled in windrows to dry.
2. Use native materials in embankments only after optimum moisture content has been reached.
3. Material should be free from organic materials, other deleterious materials and

frozen sections.

D. Geotextile: Woven, polypropylene reinforcement fabric.

1. Amoco 2006 or,
2. Mirafi 500 X or,
3. Approved equivalent.
4. Or as indicated on the plans.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities on and adjacent to Owner's property from damage caused by settlement, lateral movement, undermining, washout and other hazards created by rough grading operations.

B. Protect survey markers on and adjacent to Owner's property including but not limited to iron pipes and rods, concrete and stone monuments, hubs, stakes, etc.

C. The following are prohibited within the drip line of all vegetation to remain:

1. Stockpiling construction materials, including soil.
2. Vehicular traffic.
3. Parking of any vehicle or equipment.
4. Discharging solid or liquid waste.
5. Servicing vehicles, machinery or equipment.
6. Placing shanties, sheds and other temporary enclosures.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active. Comply with regulations and requirements of utility authority. (Provide temporary means of conveyance for all disturbed utilities as required until such a time the new systems are operational).

E. Bench existing slopes where embankments are to be placed on slopes steeper than 1 (vertical) on 5 (horizontal).

1. Bottom of bench: Sloped at approximately 2 percent, draining downhill, without depressions.
2. Sideslope of bench: At a stable angle of repose suitable to sustain itself until placement of embankment material.
3. Place embankment material as soon as each bench is complete.

### 3.2 INSPECTION

A. Examine the site to verify:

1. All protective measures are in place.
2. Field stake-out has been completed.

3.3 SPECIAL PRECAUTIONS

A. The use of explosives is not permitted. Do not bring explosives onto the site or use in the work of this Contract.

B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner. Report findings to Engineer.

C. Perform excavation within drip line of trees to remain by hand, and protect the root system from damage or dry out.

D. Protect newly graded areas from traffic and erosion, and keep them free of trash and debris until completion of the work of this Contract.

E. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace in accordance with applicable laws and codes where sloping is not possible because of space restrictions or stability of material excavated.

F. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

G. The Contractor is responsible for all means of erosion control during all phases of construction, at his expense. Any damage due to erosion conditions shall be repaired by the Contractor at no cost to the Owner and to the satisfaction of the Engineer.

3.4 HANDLING MATERIALS

A. The moisture content of a material may be such that its use will require extensive manipulation. It is the Contractor's responsibility to determine the economics of using, or disposing and replacing such materials. Material determined by the Contractor to be uneconomic for use may be disposed of as specified and replaced with other material at no additional cost to the Owner.

B. Stockpile satisfactory excavated materials until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and drying. Protect from contamination.

C. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

D. Where subgrade or lifts of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or lifts of soil material, to prevent free

water appearing on surface during or subsequent to compaction operations.

E. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

F. All excavated unsuitable and excess materials are the Contractor's responsibility for disposal at an off-site location in a legal manner.

3.5 ROUGH GRADING

A. Establish required subgrades by cutting, filling and compacting.

1. Subgrades should conform to cross sections, elevations and grades of finished grades with allowances for depth of finish improvements. Subgrades shall comply with allowable tolerances. Failure to do so shall be at the contractor’s risk and cost.

3.6 GRADING BELOW REQUIRED SUBGRADES

A. Fill all unauthorized excavation in subgrade areas with compacted select granular subgrade material without altering required subgrade elevations.

1. Concrete fill may be used to bring subgrades to required elevations only when approved in writing by the Engineer.
2. Notify Engineer of unauthorized excavation before commencing remedial work.

B. Unauthorized excavation in lawn and landscape areas may be filled with the material otherwise specified for placement on subgrade at no additional cost to the Owner.

C. If unsuitable bearing materials are encountered at required subgrade elevations, notify the Owner and Engineer and proceed with the following operations at no additional cost to the owner.

1. Carry excavations deeper until suitable bearing material is encountered or as required.
2. Remove unsuitable material and dispose of in a lawful manner.
3. Place geofabric on undercut subgrade.
4. Place select granular subgrade material and compact in lifts to required subgrade elevations.

D. If established subgrades on suitable material become unsuitable because of saturation due to Contractor's failure to provide de-watering, or other construction operations, proceed with the operations specified in the preceding paragraph at no additional cost to the Owner.

3.7 ROCK

A. Where footings, foundations or other work requiring soil support rest entirely on rock, remove all loose soil and rock at required subgrade elevations.

B. Where footings, foundations or other work requiring soil support rest partially on rock and partially on soil, notify the Engineer immediately, before backfilling or placing other work.

## 3.8 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations at no additional cost to the Owner.

C. Establish and maintain temporary drainage ditches and other diversions outside grading limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

D. The Contractor is responsible for providing all the necessary means of dewatering for the duration of the project. Areas damaged due to improper dewatering methods shall be repaired at no cost to the Owner to the satisfaction of the Engineer.

## 3.9 FILLING AND COMPACTING

A. Place geofabric on subgrade according to manufacturer's instructions so it lays flat without creases, folds, or other irregularities. Minimum overlap at joints: 18 inches.

B. Place embankment materials in lifts not exceeding 12 inches in loose depth according to DOT Specs, Section 203-3.10.

1. Stumps, logs and other decomposable materials are not to be used in any part of embankments.

C. Compact each lift of embankment material as specified in DOT Specs, Section 203-3.12.

1. In all areas other than those supporting lawns and landscape areas: to at least 95% of Modified Proctor Maximum Dry Density.
2. In all lawn and landscape areas: to a minimum of 85% and maximum of 90% of Modified Proctor Maximum Density.
3. In detention basin fill areas: to a minimum of 80% and maximum of 85% for the basin bottom and at least 95% of Modified Proctor Maximum Density for weir or berm (earth containment) areas.

## 3.10 PROOF ROLLING

A. Immediately prior to final trimming of the subgrade and placement of subbase materials for roadways and miscellaneous surfaces, all areas of the subgrade shall be proof rolled.

1. On embankments conforming to DOT Specs, Section 203-3.13.
2. In cut sections conforming to DOT Specs, Section 203-3.14.

B. If proof rolling reveals unsatisfactory bearing conditions:

1. In cut: proceed according to paragraph 3.6 C of this specification as directed.
2. On embankments: proceed according to paragraph 3.6 D of this specification as required, at no additional cost to the Owner.

## 3.11 REMEDIAL ACTION

A. If field density reports or inspection by the Owner or Engineer reveal that subgrades or embankments have been constructed below specified density, provide additional compaction and testing at no additional cost to the Owner until specified densities are achieved.

B. 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. Where settling is measurable or observable during general project warranty period, remove surface (pavement, lawn or other finish), add originally specified material, substituting select granular subgrade material for native 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.

D. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerance. Subgrade areas which do not comply with the allowable tolerances set forth in these specifications. Shall be reestablished to such tolerances and approved by the Engineer for substantial compliance.

END OF SECTION 31 22 13

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# SECTION 31 23 00

# EARTHWORK

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this Section.

### 1.2 SUMMARY

A. Work Included:

1. Excavation, backfill, grading, and compaction relating to all phases of construction.
2. Importing and exporting material fill as required to meet final grades.

B. Related Sections include the following:

Section 02 30 00: Soil Testing Services.
Section 31 11 00: Clearing and Grubbing.
Section 31 22 13: Rough Grading.
Section 31 23 16: Trenching, Backfilling & Compaction.
Section 32 12 16: Asphalt Concrete Paving, Surfacing and Striping.
Section 32 91 13: Soil Preparation and Soil Mixes.
Section 32 92 00: Lawns.

### 1.3 UNIT PRICES

A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches beneath bottom of concrete slabs on grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Unit prices for rock excavation include replacement with approved materials.

C. Unit prices for unsatisfactory soils include excavation of soils and replacement with approved materials.

## 1.4 DEFINITIONS

A. Backfill: Soil materials 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: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as required by the Engineer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without a request by the Engineer. Unauthorized excavation, as well as remedial work required by the Engieer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or blasting, when permitted:

1. Excavation of Footings, Trenches, Pits and Bulk Excavations: Late-model, track-mounted hydraulic excavator; equipped with a 42 inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAEJ-1179.
2. If the material can be removed by ripping, plowing or excavating equipment from any direction, the material shall not be classified as rock.

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: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

M. Unsatisfactory soil: Soil which in the opinion of the Engineer is incapable after compaction of properly supporting the utility pipe or structure. The ability of soils listed in paragraph 2.1 C to provide proper support will be based upon field conditions.

## 1.5 SUBMITTALS

A. Product Data: For the following:

1. Drainage fabric.
2. Separation fabric.
3. All Products.

B. Samples: For the following:

1. Soil gradation results for each proposed soil material.
2. 12-by-12-inch sample of drainage fabric.
3. 12-by-12-inch sample of separation fabric.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTMD 2487 of each on-site or borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTMD 698 for each on-site or borrow soil material proposed for fill and backfill.
3. Laboratory compaction curve according to ASTMD 1557 for each on-site or borrow soil material proposed for fill and backfill.

## 1.6 QUALITY ASSURANCE

A. Comply with latest requirements of:

1. OSHA.
2. NYS Department of Labor.
3. NYS Department of Transportation
4. NYS Department of Environmental Conservation.
5. Other agencies with jurisdiction.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. (Geotechnical Report referenced material).

B. Satisfactory Soils: ASTM D 2487 in classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials in accordance with Geotechnical Report.

E. Backfill and Fill Material for Utility Trenches Outside of Building (use under paving): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting gradation of NYSDOT Section 304, Type 4.

F. Subbase (use under pavement, walks and running track components where applicable.): Material shall consist solely of approved blast furnace slag or of stone which is the

product of crushing ledge rock; meeting gradation of NYSDOT Section 304.13, Type 2. (Crusher Run) depth as indicated on plans.

G. Structural Fill: Artificially graded mixture of crushed stone meeting gradation of NYSDOT Section 304, Type 4, and in accordance with Geotechnical Report.

H. Pipe Bedding and Pipe Zone Backfill Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone or slag, meeting gradation of NYSDOT Section 703, Table 703-4 Type 1 or 1A, as indicated.

I. Drainage Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting gradation of NYSDOT Section 304, Type 4 (where applicable.)

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state. (Shall be approved by Engineer).

2.2 ACCESSORIES

A. Filter Fabric: (Separation Fabric) Manufacturer's standard nonwoven geotextile fabric of polypropylene, nylon or polyester fibers, or a combination, with the following properties: Amoco 4545 or equivalent:

1. Grab Tensile: 90 lbs., ASTM D 4632.
2. Grab Elongation: 50%, ASTM D 4632.
3. Mullen Burst: 225 psi, ASTM D 3786.
4. Puncture: 65 lbs., ASTM D 4833.
5. Trapezoidal Tear: 45 lbs., ASTM D 4533.
6. U.V. Resistance (Strength Retained): 70%, ASTM D 4355.
7. Equivalent Opening Size: 70 min. U.S. Sieve Number, ASTM D 4751.
8. Permittivity: 2.5 $sec.^{-1}$, ASTM D 4491.
9. Flow Rate: 175 $gal/min/ft^2$, ASTM D 4491.

B. Soil Reinforcement/Erosion Control Matting: Shall be a three dimensional geomatrix of heavy nylon monofilaments fused at their intersections, with 95% of the geomatrix being open space, meeting the following properties unless otherwise indicated.

| Property | Value |
|---|---|
| Carbon Black content by weight | 2% |
| Nominal Weight ($02/yd^2$) | 12.0 |
| Minimum Weight ($02/yd^2$) | 11.1 |
| Thickness (inches) | 0.75 |
| Minimum Filament Diameter (inches) | 0.016 |

| | |
|---|---|
| Tensile Strength (lbs/ft length) | 250 |
| Tensile Strength (lbs/ft length) | 120 |
| Tensile Elongation - Length (%) | 75 |
| Tensile Elongation - Width (%) | 75 |

C. Pavement Fabric for walks, track events and artificial turf field: As indicated on plans.

## 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 earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. 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, as ordered by Engineer as required and/or as required by the Engineer during all phases of construction.

### 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.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required. Damage to existing and/or new components of the site due to excess water shall be repaired at no cost to the Owner and to the satisfaction of the Engineer.

### 3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

### 3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

2. Rock excavation includes removal and disposal of rock.

a. Do not excavate rock until it has been classified and cross-sectioned by Engineer.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete form work, for installing services and other construction, and for inspections.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS (where applicable)

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades. Refer to Section 312213 for subgrade tolerances.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of pipe to the depths required by the Contract Documents. Refer to Section 312316.

B. Excavate trenches to uniform widths to provide a working 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 on each side of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade. Refer to Section 31 23 16: Trenching, Backfilling and Compaction, and Contract details.

3.8 APPROVAL OF SUBGRADE

A. Notify Engineer and Construction Manager when excavations have reached required subgrade.

B. If the Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

   1. Additional excavation and replacement material will be paid for under time and material as approved by the Engineer.

C. Proof roll subgrade with a 10-ton vibratory roller to identify soft pockets and areas of excess yielding. Soft pockets should be excavated and backfilled with Controlled Fill material. Do not proof roll wet or saturated subgrades. Proof roll to be witnessed by the Engineer.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as required by the Engineer at no cost to the Owner.

E. Subgrade compaction shall be as stated in Section 31 22 13: Rough Grading. Methods are the responsibility of the contractor.

F. The Site Contractor is completely responsible for establishing the grades indicated within the tolerance indicated for the establishment of the subgrade. The subgrade shall be sloped mirroring the final grades of the turf field at those respective elevations allowing for the proper construction of the subbase system. The Site Contractor shall provide an as-built survey once the subgrade has been established to ensure it meets the required grades. The survey shall include spot grades at 20 feet on center in all directions. The Contractor shall make all necessary grade adjustments/corrections until such time that the subgrade has been approved.

G. Subgrade shall be established using laser grades equipment only.

## 3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction or utility pipe as required by the Engineer at no cost to the Owner.

## 3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactorily excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees to remain.
   2. Stockpile at location approved by the Owner.

## 3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, damp roofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

## 3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where required by the contract documents. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in minimum of 4 inches of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of subbase material, free of particles larger than 1-inch, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

G. Place and compact final backfill of satisfactory soil materials to final subgrade.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under steps and ramps, use Structural Fill.
2. Adjacent to pavement areas: Structural Fill.
3. Under Asphaltic Pavement and Portland Cement Pavement: As indicated on Plans

3.14 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill 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.

3.15 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 12 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 tempers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil 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 material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at a minimum of 85% and maximum of 90%.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free from 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.

3.17 SUBSURFACE DRAINAGE (where applicable)

A. Drainage Piping: As indicated on Plans.

B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a 6-inch course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches. (Perimeter drain shall be as indicated on Plans.)

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTMD 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, to width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.

1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM 698.
2. Place and compact impervious fill material over drainage backfill to final subgrade.

3.18 DRAINAGE COURSE

A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D-1557.
2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verifications and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Engineer.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at locations and frequencies indicated in Specification Section 313200 - Soil Testing Services.

E. 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 depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion.Keep free of trash and debris.

B. Repair and re-establish 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 required by the Engineer; 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 the greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

3.22 SPECIAL SITE CONDITIONS

A. Contractor shall fully familiarize himself with the Geotechnical Report that describes the conditions at this site. Contractor shall follow site development guidelines identified in Geotechnical Report.

END OF SECTION 31 23 00

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# SECTION 31 23 16

# TRENCHING, BACKFILLING AND COMPACTION

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Unclassified earth excavation for construction of pipe, conduit, manholes, catch basins, appurtenances, and structures outside of building lines.

B. Disposal of excavated materials, salvage of material for backfill, and removal of excess or material not suitable for re-use.

C. Maintenance of excavations including sheeting, dewatering, bridging and fencing outside of building lines.

D. Construction of bedding, pipe zone and trench backfill, outside of building lines.

E. Protection of utilities, outside of building lines.

F. Protection of trenches and open excavations, outside of building lines.

G. All work shall be in strict compliance with the Geotechnical Report.

1.3 RELATED SECTIONS

Section 02 30 00: Soil Testing Services.
Section 31 22 13: Rough Grading.
Section 31 23 00: Earthwork.
Section 33 11 16: Water System.
Section 33 40 00: Storm Sewer Systems.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Comply with New York State Department of Labor Board of Standards and Appeals Part 23 of Title 12.
2. Comply with Subpart P, "Excavations, Trenching and Shoring" of United States Department of Labor OSHA Regulations for Construction.
3. Comply with rules, regulations, and laws concerning construction activity in roads

of the applicable jurisdiction.

4. Comply with all other applicable regulations.

B. Testing Laboratory: As specified in Section 023000 Soil Testing Services.

C. Reference Standards: NYSDOT Specifications.

D. Allowable Tolerances:

1. Alignment of Excavation: To permit construction of pipe, structures, and appurtenances to the tolerances specified under pertinent drawings and specifications.

   a. Trench bottom vertical alignment: Excavate to the required elevations below proposed pipes and other structures for proper vertical alignment. Do not over excavate below dimensions indicated for the proposed utilities.
   b. Trench sides horizontal alignment: Do not excavate less than dimension shown on Contract Drawings. Note and comply with any limit of payment dimensions shown on plans or as specified.

2. Bedding: Construct bedding with specified material as indicated.

1.5 SUBMITTALS

A. Reports: Before using material for special trench backfill, pipe zone backfill, or bedding, submit samples from each typical source to an approved soils testing laboratory and submit reports for approval as follows:

1. Submit six copies of the gradation analysis of gravel from each source used for trench backfill, bedding, or subbase.
2. Submit six copies of the gradation analysis of crushed stone from each source.
3. Submit six copies of the gradation analysis and compaction requirements for each typical class of select backfill used for trench backfill as shown on the plans:

   a. Report from soils testing laboratory should state any special manipulation or compaction requirements required to achieve specified density or supportive value for each class of type of select backfill.
   b. Re-testing of backfill compacted in place may be required at any time or place as required by the Engineer.

B. Shop Drawings: Prior to start of work, submit shop drawings and details, for all materials to be incorporated into the work.

C. Samples: Prior to the start of backfill grading, submit the number and size of samples requested by the Owner and Engineer for acceptance.

D. Product Data: Submit products data for all materials, including but not limited to:

1. Plastic Warning Tape (each type).
2. Geotextiles.
3. Controlled low-strength material, including design mixture.
4. Geofoam.

E. All submittals must receive approval prior to being incorporated into work. Failure to do so shall be at the Contractor's risk and expense.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store and stockpile material suitable for backfilling away from interference with traffic, and nearby residents. Use all stockpiled material as soon as practical. Do not allow material to become contaminated. Do not allow material to erode or wash into trench, onto road or adjacent property.

B. Load and haul away excavated material not suitable for other uses at the site. Use haul routes approved by the municipality having jurisdiction.

1.7 PROJECT CONDITIONS:

A. Notify: Dig Safely, 1-800-962-7962, not less than 72 hours prior to starting excavation for location of gas, telephone and electric lines.

B. Notify other private and public utilities in the work area.

C. Notify Owner and Engineer at least 24 hours prior to trenching and backfilling.

1.8 PROTECTION OF PERSONS AND PROPERTY

A. It shall be noted and stressed that this contractor’s installations will be made during a period when the existing building(s) are in use. Contractor shall schedule and conduct their operations so as to cause the least amount of inconvenience to the Owner. Contractor shall provide all possible safe-guards to protect students and others at the site.

B. Barricade open excavations occurring as part of this work. Furnish night lighting as required.

C. Contractor shall furnish, erect and maintain barriers where feasible or directed to separate construction activities from other operations on site. Gates may be provided where required. Contractor shall limit operations and activities to fenced areas where applicable.

D. Protect structures, utilities, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards caused by earthwork operations.

E. Perform any shoring and bracing required to safely do the work required. Maintain sides

and slopes of elevations in a safe manner. Provide necessary sheet piling and/or shoring needed for protection of workman, materials, buildings, other properties, and the public.

F. Locate excavations support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

G. Monitor excavations support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

H. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

I. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

J. Contractor is responsible for all sheet piling and shoring required, any sheet piping provided is to be installed under supervision and approval of a Registered Professional Engineer in the State of New York.

1.9 EXISTING UTILITIES

A. 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.

B. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer, and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Engineer not less than (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner and Engineer immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

1.10 WATER CONTROL

A. Contractor shall furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations if required and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
4. Remove dewatering system if no longer needed.

B. It is the responsibility of the Contractor to examine all available information prior to bidding to determine existing water table elevation. Dewatering must be covered in Base Bid, no extra compensation for dewatering will be allowed.

C. Comply with water disposal requirements of authorities having jurisdiction.

D. Installation: Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

E. Before excavating below ground-water level, place system into operation to lower water below excavation depth. Operate system continuously until construction is complete and fill materials have been placed, or until dewatering is no longer required.

F. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed.

1.11 PIPING TRENCH EXCAVATION

A. Excavation shall allow for direct buried anchors. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are located in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines. The excavation should be in a straight line except where fittings are located.

B. The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation but in accordance with current OSHA Standards.

C. Where suitable soil exists, pipe shall be installed to comply with ANSI/ AWWA C151/ A21.51 Laying Condition Type 2. This shall consist of a flat bottom trench with undisturbed earth backfilled and lightly consolidated to centerline of pipe. Where drainage pipe is installed, bottom of trench shall be uniformly sloped. In all cases, pipe bells shall be excavated to provide uniform support.

D. Where unsuitable material exists, pipe shall be installed to comply with ANSI/ AWWA C151/ A21.51 Laying Condition Type 4. This shall consist of a pipe bedded in sand, gravel or crushed stone ASTM D2940; except 100% passing a 1" (25mm) sieve and not

more than 8% passing a No. 200 (.075mm) sieve; to depth of 1/8 pipe diameter, 4" minimum. Backfill compacted to top of pipe 80% Standard proctor factor AHSHTO T-99.

E. If necessary to remove unsuitable material to a depth greater than specified, refill excavations carried below the depth indicated or directed with specified bedding material in 6-inch lifts compacted to 95% of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the Contractor's operations or soils permitted to soften from exposure to weather, with bedded material and compact with a plate-type vibratory compactor to the specified density.

1.12 REMOVALS

A. Perform the work of demolition at the existing sites as indicated on the drawings and/or as required by the new construction. All materials removed shall be examined by the Owner. Those materials designated by the Owner as "scrap" shall become the property of the Contractor and removed from the site; Materials to be retained by the Owner shall be delivered to the Owner at location as directed.

B. All excess soil removed from excavations, existing concrete sidewalks, etc. not to be reused as backfill, shall be trucked from the site and disposed of by the Contractor.

1.13 MAINTENANCE & REPAIR OF EXISTING FACILITIES

A. Before work is started, the contractor shall inspect the existing work which will be affected by his operations. For the contractor this will include, but is not limited to, driveway, roads, lawn area, walks, shrubbery, etc.

B. Contractor shall report in writing any observed defects to the Owner in order to avoid his being held responsible for damage which may not be his fault.

## PART 2 - PRODUCTS

2.1 MATERIALS

A. Imported Pipe Bedding:

1. Crushed stone meeting New York State Department of Transportation (NYSDOT) Designation 703-4, Type 1A stone.

B. Sand: An imported or native natural run-of-bank sand graded from fine to coarse particles, free of lumps and frozen material. It shall not contain slag, cinders, ashes, rubbish, vegetation, or other foreign material (shall not contain any stones larger than 1/2" diameter). (Native material must be approved by Engineer).

C. General Fill: Native onsite soils capable of meeting compaction requirements, and in accordance with the Geotechnical Report. (Material shall be approved by Engineer).

D. Processed Gravel: Gravel meeting NYSDOT 304-2.02 Type 4.

E. Temporary Fencing (where required by site conditions):

1. Materials may be new or used.
2. Wire Fabric: 0.083 inch diameter (No. 14 B.W.D.) with maximum size openings of 2 inches wide, 4 inches high.
3. Minimum height: Five feet.
4. Posts: Metal. T or U Type, minimum length eight feet, driven into ground at least two feet.
5. Signs: Size 16 inches by 24 inches with 5 inch black letters on orange background, message:

"DANGER-KEEP OUT".

2.2 SUITABLE BACKFILL MATERIAL

A. Excavated or borrow material shall be predominantly granular, non-expansive and free from roots, rocks or lumps over 3" and deleterious matter.

1. Gravel: Run of bank gravel, reasonable free of loam, silt and clay.
2. Stone: Select, graded crushed stone, free from organic, frozen or deleterious matter.

2.3 GRASS RESTORATION

A. Refer to Section 32 92 00: Lawns.

2.4 PAVEMENT RESTORATION

A. Provide Asphalt concrete base course per NYSDOT Section 401-2 Type 1 as noted below:

1. Heavy Duty – 8" (in 2" lifts)
2. Medium Duty – 3"
3. Light Duty – 0"

B. Provide Concrete 8" concrete base per NYSDOT Section 503 concrete class C or F.

C. Provide 2" asphalt concrete binder course per NYSDOT Section 401-2 Type 3.

D. Provide 1-1/2" asphalt concrete top coat per NYSDOT Section 401-2 Type 7F.

E. Cap seams with bituminous asphalt filler per NYSDOT material designation 702-05 or 702-3401.

2.5 SOIL MATERIALS

A. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Sand: ASTM C 33; fine aggregate, natural, or manufactures sand.

2.6 GEOTEXTILES

A. Refer to Section 33 46 26: Geotextiles Fabrics.

2.7 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 INSPECTION

A. Prior to all work, carefully inspect the site and verify that construction may properly commence.

1. Before excavation, verify:

a. Work layout, horizontal and vertical, and conformance of layout with Contract Drawings.
b. Limits of construction.
c. Utility locations including, but not limited to: aerial, pole lines, buried, underground, transmission, local service, and individual connections.

2. After excavation, verify that pipe, structures and appurtenances to be placed in trenches may be installed in accordance with pertinent drawings and specifications.

3. Before backfilling, notify the Owner and Engineer at least 24 hours in advance and verify:

a. Pipe, structures and appurtenances have been installed in accordance with pertinent drawings and specifications, and joints are secure.

b. Utilities are adequately continued, supported and maintained without damage.

B. In the event of discrepancy or unsatisfactory condition, immediately notify the Owner and Engineer.

3.2 PREPARATION

A. Utility Protection and Changes: Where public and/or private utilities are encountered:

1. Maintain, support, and save from damage all public utilities.
2. Allow reasonable time and space for owner of private utilities to cooperate in maintaining their facilities.

3.3 PERFORMANCE

A. Excavation: Perform all trenching for construction of pipe, appurtenances, structures, bedding, and backfill. Remove surface materials and drainage facilities:

1. Disposal of excavated material:

a. Store material suitable for backfill. Protect from contamination.
b. All surplus earth, rock and other unsuitable or unsatisfactory material shall be disposed of off project site by Contractor.

2. Perform excavation in such manner and to such widths as will give ample room for installing the pipe, appurtenances and structures, and for sheeting, bracing, pumping and draining. Dewater the excavation and maintain the dewatered condition as required to perform the construction and install compacted backfill.

3. Do not disturb bottom of excavation at structures requiring a cast-in-place concrete base. In case material is disturbed or saturated, carefully excavate to undisturbed level and fill with concrete at no additional cost to Owner.

4. Unauthorized Excavation: Unauthorized excavations carried outside lines and grades shown on Contract Drawings shall be filled by Contractor at no additional cost to Owner as follows:

a. Below concrete cradle, concrete encasement or concrete foundation, fill unauthorized excavations with 3000 psi concrete.
b. Below specified bedding, fill unauthorized excavations with compacted bedding material.

5. Maintenance of Trench:

a. Keep sides of excavation from slides, cave-ins. Use any method including but not limited to: temporary sheeting, shoring, bracing, and cribbing.

b. Keep excavations free from water. Use any method including but not limited to gravity flow, pumping, sumps. Maintain excavation in a dry condition until backfill has been placed and compacted a minimum of 18 inches above top of pipe. In all cases, maintain dry trench at backfill level.

6. Schedule:

a. Advance excavation operations ahead of pipe laying to allow for field conditions.
b. Limit excavations ahead of pipe laying a maximum of 200 feet, unless more is approved by the Engineer in writing.

B. Bedding and Pipe Zone Backfill: The trenches for pipelines shall have bottoms as shown on the Contract Drawings conforming to the required grades. All excavations for pipe lines shall be made to the depths shown for pipe bedding.

1. If the bottom of trench becomes unsuitable for pipe laying due to Contractor's operations, he shall provide extra excavation and backfill suitable to the conditions at the area and bedding specified, at no additional cost to Owner.
2. If the undisturbed bottom of the trench is soft and, in the opinion of the Engineer, cannot support the pipe or structure, additional trench depth shall be excavated as ordered by the Engineer and refilled with specified bedding material.
3. Bedding and Pipe Zone Placement:

a. Place and compact bedding material in trench bottom.
b. Install pipe conforming to the required line and grade.
c. Place and compact pipe zone backfill material in six-inch-thick layers as shown on the Contract Drawings.

4. Bedding and Pipe Zone Compaction:

a. Below pipe and structures: Compact to not less than 95% of modified proctor maximum density, at or below optimum moisture content in conformance with ASTM D 1557.
b. Material shall be deposited evenly on both sides of the pipe in tamped layers not exceeding 6 inches in depth until at least three-fourths the depth of the pipe has been reached. For wide trenches, tamping shall be done for a distance on each side of the pipe equal to at least the diameter of pipe. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense.

5. Ditch Line Dikes: Construct an impervious earth dike at trench bottom, as required, and at property lines to keep free water from traveling downstream along solid pipes and eroding pipe bedding. Ditch line dikes are not to be installed in underdrain trenches.

a. Construct dike of clay or other impervious material.

b. Construct one foot thick and from bottom of trench to top of pipe and at every catch basin and manhole, at 100 foot intervals and at the inlet end of culverts.

C. Backfill - General:

1. Backfill excavations as shown on the Contract Drawings. Materials shall be placed and compacted from the top of the pipe zone backfill to the surface of the ground or the bottom of any special surface treatment, such as pavement subbase or topsoil.

   a. Do not backfill against masonry walls or other structures until they have attained sufficient strength to safely resist the thrust of fill materials.
   b. Do not backfill with frozen materials.
   c. If settlement or washout occurs before Final Inspection, furnish, place and compact additional material to resurface the low places as required by the Owner.
   d. Maintain dust control at all times.

2. Heavy equipment shall not be allowed to pass over the pipe until a fill of at least two (2) foot depth has been placed over the top of the pipe. In any case, movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. When determined by the Owner, any pipe that is damaged or disturbed through any cause, shall be replaced as required by the Owner, at the expense of the Contractor and at no cost to the Owner.

3. Methods of Compaction:

   a. Hand Compaction: Tamping by hand with flat hand tampers.
   b. Mechanical Compaction: Compaction by means of vibratory or other mechanical tampers.

4. Compact Backfill to 95% Modified Proctor Density Compaction:

   a. Backfill material shall be placed in horizontal layers not exceeding six (6) inches thick and be thoroughly compacted by mechanical compaction.

D. Utility Protection:

1. Contractor shall hold the Owner harmless against:

   a. Injury to electric, telephone lines, gas, water lines, and other underground and overhead utilities.

E. Temporary Wire Fence:

1. Where trenches and open excavation are left unattended during non-working hours or days, furnish and maintain temporary fences.

2. A temporary wire fence will be required except where temporary sheeting is extended a minimum of three feet above ground surface, and no void exists between sheeting and side of excavation.

3. Provisions for this fencing are in addition to provisions the Contractor would normally make to safeguard his work operations and in no way diminish his obligations in this respect.

4. Construction Details:

   a. Construct temporary fence to completely surround all excavations.
   b. Mount "DANGER-KEEP OUT" signs at intervals not exceeding 50 feet along fence line.
   c. Provide posts or adequate supports for fencing at intervals not in excess of 10 feet. Stretch and fasten wire fabric at top, middle and bottom of each support.

## 3.4 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Testing laboratory must inspect and approve subgrades and fill layers before further construction work is performed thereon. Refer to Section 313200.

B. If testing laboratory subgrade and/or fill reports are below specified density, provide additional compaction at no expense to Owner.

## 3.5 PAVMENT PATCHING

A. Existing pavement shall be saw cut to obtain a straight and neat edge for paving. Saw cut shall be made prior to paving after backfill of trench to bottom of new pavement.

B. All seams between existing and new asphalt surfaces shall be sealed with an asphalt filler corresponding to the material requirements of N.Y.S.D.O.T. Material designation 702-05 or 702-3401.

C. Concrete for new base shall correspond to requirements of N.Y.S.D.O.T. section 503. Concrete class C or F.

D. Top of new concrete base shall be even with or lower than top of existing concrete base to provide full thickness of asphalt top and binder and minimum 8" of concrete base.

E. No asphalt shall be placed on concrete until the concrete develops a minimum strength of 2000 P.S.I. The minimum duration between placement of concrete and asphalt shall be 48 hours. Tack coat surface of the concrete prior to receiving asphalt. Tack coat shall correspond to the material requirement of N.Y.S.D.O.T. material designation 702-30.

F. If an asphalt base course is present, the bottom of new asphalt base course shall match the bottom of or be set below bottom of existing asphalt pavement. Minimum thickness shall be:

1. Heavy Duty Pavement – 8" (placed in 2-4" lifts)
2. Medium Duty Pavement – 3"
3. Light Duty Pavement – 0"

G. Top of conduit shall be a minimum of 7'-0" below the surface of State highways and 30" below other paved roadways.

3.6 GRADING

A. Uniformly grade areas within limits of this work, including adjacent transition areas. Compact with uniform levels or slopes between finished elevations and adjacent existing grades.

B. Grade areas to achieve drainage away from structures and to prevent ponding.

C. Soft spots are to be re-excavated and backfilled with suitable material.

3.7 MAINTENANCE

A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

B. Where compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape and re-compact to required density.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. If specifically directed by Owners Representative, transport acceptable excess excavated material to designated soil storage areas on the Owner's Property.

END OF SECTION 31 23 16

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# SECTION 31 23 19

# DEWATERING

## PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 31 23 00, EARTHWORK

C. Section 31 50 00, SUPPORT OF EXCAVATION

1.03 SYSTEM DESCRIPTION:

A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.

B. Normal dewatering is defined as using conventional pumps installed in open excavations, ditches, or sumps. Special dewatering is defined as using single or two stage wellpoints, deep wells, or eductor and ejector systems installed in drilled holes or jetted in place.

1.04 QUALITY ASSURANCE:

A. The Contractor is responsible for the adequacy of the dewatering systems. He shall retain the services of a Professional Engineer registered in the state where the project is located, experienced in dewatering systems, to independently evaluate the boring logs and any other soils information available to determine those areas that will require special dewatering techniques and to design the required system. The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the dewatering is carried out in accordance with his design.

B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise required by the Engineer, so that all excavation bottoms are firm and dry.

C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.

D. The dewatering system and excavation support (see Section 31 50 00) shall be designed so that lowering of the groundwater level within the work area does not adversely affect structures, utilities or wells outside of the work area.

E. Where special dewatering is used, the Contractor shall obtain at his expense the services of a registered professional engineer to investigate, design and monitor the dewatering system. The Contractor shall also furnish materials and install at least two observation wells at each excavation area. The location of the wells shall be determined in the field by the Contractor's engineer.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. At least two weeks prior to installing his dewatering system, Contractor shall submit the attached Certificate of Design completed and signed by Contractor, identifying the engineer responsible for design of the dewatering system. He shall also submit a schedule showing the timing of installation and operation of the dewatering system.

B. The Contractor shall submit to the Engineer for record purposes only, the following items bearing the Contractor's Engineer's stamp and signature, and identifying the codes and specifications followed in the design.

1. Plans and description of the dewatering system, including the number, location and depth of wells, wellpoints or sumps; designs of filters to prevent pumping of fine soil; method and location for filtering and disposal of pumped water; and flow capacity of proposed system.

2. Locations of observation wells.

C. The Contractor shall submit records of pump operation and groundwater elevations as required by the Owner's Engineer.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

A. All water pumped or drained from the work shall be disposed of in a manner which will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the project General Conditions, Supplementary Conditions, Section 00 31 43 – PERMITS, and shall comply with all rules, regulations, laws and ordinances of the municipality, the State of New York, and other authorities having jurisdiction over the project site or work. All labor, materials, equipment and services necessary to make the work comply with these requirements shall be provided by the Contractor without additional cost to the Owner.

B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.

C. Dewatering procedures to be used shall be as described below:

1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged. Crushed stone shall be wrapped in filter fabric to prevent loss of fines.

2. For dewatering operations with relatively minor flows, pump discharges shall be directed into haybale sedimentation traps lined with filter fabric. Water is to be filtered through the haybales and filter fabric prior to being allowed to seep out into its natural water course.

3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall be used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.

4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags are to be utilized in catchbasins.

D. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Owner.

3.02 SPECIAL DEWATERING:

A. If conventional dewatering methods are inadequate to ensure dry and stable conditions for structural foundations, the Contractor shall be required to use special dewatering as necessary.

B. Special dewatering techniques may consist of one or two stage wellpoint systems, deep wells, or eductor and ejector type systems. The Contractor shall utilize a system which provides proper construction conditions and prevents settlement at time of installation and upon backfilling.

C. In areas requiring special dewatering, the Contractor shall lower the groundwater level to a minimum of 2 feet below the bottom of the final excavation grade prior to any excavation and maintain that groundwater level until the excavation has been backfilled. The groundwater levels shall be monitored by the Contractor's engineer to ensure conformance with the requirements of these specifications. Construction will not be allowed until the Owner's Engineer is satisfied that the above provisions are met.

END OF SECTION

(Certificate of Design follows this page)

# CERTIFICATE OF DESIGN

Re: Contract Between:

OWNER: _____
(Name)

and
CONTRACTOR: _____
(Name)

on
CONTRACT: _____
(Number)

Date: _____

Title: _____

Contractor hereby certifies that _____:
(Engineer)

1. Is licensed or registered to perform professional engineering work in the state of _____;
(Location of Project)

2. Is qualified to design the _____
(Item)
specified in Section _____ of subject contract;

3. Has designed _____ before;
(Item)

4. Has prepared the design in full compliance with the applications and requirements of Section _____ of subject contract including all applicable laws, regulations, rules, and codes; and

5. The work has been signed and sealed pursuant to applicable state law.

FOR: _____
(Contractor)

BY: _____
(Signature)

_____
(Name and Title)

Dated: _____

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# SECTION 31 25 00

# SEDIMENT AND EROSION CONTROL

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Applicable provisions of the Contract Documents govern work under this section.

### 1.2 SUBMITTALS

A. In accordance with Shop Drawings, Product Data, and Samples Specification Section, designate erosion control and maintenance activities on submitted Project Schedule.

B. Submit pre-construction photographs and short narrative of erosion control implementation plan as specified herein.

C. Project Schedule: Contractor shall provide construction schedule indicating schedule of work with key milestones for each phase of construction.

D. Complete required forms and documentation as indicated in the project Stormwater Pollution and Prevention Plan (SWPPP).

E. Qualified Inspector Certifications: Contractor shall provide Certifications of all Qualified Inspectors performing monitoring and reporting per requirements of the Stormwater Pollution and Preventions Plan (SWPPP).

### 1.3 RELATED SECTIONS

Section 31 11 00: Clearing and Grubbing.
Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 32 12 16: Asphaltic Concrete Paving, Surfacing, and Striping.
Section 32 92 00: Lawns.

### 1.4 WORK INCLUDED

A. Provide all labor, equipment and materials necessary to install and maintain erosion control blankets, silt fence, hay bale dikes, sediment traps, inlet protection, and to implement erosion control measures as shown on the plans, as specified, as required by regulatory permits, as required by the Engineer if measures are not indicated on the plans, and as job conditions dictate.

1.5 QUALITY ASSURANCE

A. All Erosion/Sediment Control activities and water quality objectives performed by the contractor shall be in compliance with the following standards of practice:

1. NYSDEC's SPDES General Permit for Stormwater Discharges for Construction Activity Permit No. GP-0-15-002.
2. NYSDEC's "New York Standards and Specifications for Erosion and Sediment Control" published by the Empire State Chapter of the Soil and Water Conservation Society, latest edition.
3. NYSDEC's "New York State Stormwater Management Design manuals" prepared by Center for Watershed Protection, latest edition.
4. USDA Soil Conservation Service "Guidelines for Urban Erosion and Sediment Control, latest revision.
5. NYSDEC Erosion and Sediment Control Guideline for New Development T.O.G.S. 5.1.10.
6. Geotechnical Report for this project (See Appendix).

B. Local Guidelines for Erosion and Sediment Control.

1. NYSDEC "Reducing the Impacts of Stormwater Runoff for New Developments", latest revision.
2. NYSDOT Specifications.
3. Project specific SWPPP, and Notice of Intent (NOI).

C. Contractor is responsible for all monitoring, reporting, and repair of erosion control measures as required by the SWPPP specific permit requirements throughout the duration of construction. Contractor shall provide a qualified inspector performing all SWPPP inspections as referenced in the SWPPP.

D. Directives of Owner, Owner's Representative, and/or regulatory personnel of authority having jurisdiction requiring further control measures as warranted.

PART 2 - PRODUCTS

2.1 MULCHES

A. Mulches shall be suitable material acceptable to the Engineer and reasonably clean and free of noxious weeds and deleterious materials. The following materials are acceptable:

Application Rates

| Mulch Material | Quality Standards | Per 1000 SF | Per Acre | Depth |
|---|---|---|---|---|
| Wood Chips or Shavings | Green or air-dried. Free of objectionable coarse material | 500-900 lbs. | 10-20 tons | 2 - 7" |
| Straw | Air-dried; free of undesirable seeds & coarse materials | 90-100 lbs. 2-3 bales | 2 tons cover 100-120 bales | about 90% surface |
| Excelsior Wood Fiber Mats | Interlocking web of excelsior fibers with Photodegradable plastic netting | 48" x 100" 2 sided plastic, 48"x 180"1 sided plastic | ---------- | ---------- |

2.2 GRASS

A. Grass shall be quick growing species suitable to the area and as a temporary cover which will not compete with the grasses sown later for permanent cover.

B. Seed Mixtures

1. Temporary Seeding

| Type | Lbs./Acre | Lbs./1000 SF |
|---|---|---|
| Ryegrass (Annual or Perennial) | 80 | 1.9 |
| Certified "Aroostook" Winter Rye | 100 | 2.5 |

Use winter rye if seeding in October/November.

2.3 SOIL AMENDMENTS

A. Fertilizer and soil conditioners shall be a standard commercial grade acceptable to the Engineer.

1. Lime: pH of 6.
2. Fertilizer: Meeting New York State Department of Transportation Specification 713-03 type 1 or as approved. 1-2-1 N.P.P. ratio.

2.4 JUTE MESH

A. Jute mesh and appurtenances shall comply with NYSDOT Specification Section 612, latest revision.

2.5 SILT FENCE

A. Field Assembled Units

1. Fabric shall meet the following minimum criteria:

| Property | Minimum Acceptable Value | Test Method |
|---|---|---|
| Grab Tensile Strength (lbs.) | 90 | ASTM D1682 |
| Elongation at Failure (%) | 50 | ASTM D1682 |
| Mullen Burst Strength (psi) | 190 | ASTM D3786 |
| Puncture Strength (lbs.) | 40 | ASTM D751 (Modified) |
| Slurry Flow Rate (gal/min/sf) | 0.3 | |
| Equivalent Opening Size | 40-80 | US Std Sieve CW-02215 |
| Ultra-Violet Radiation Stability (%) | 90 | ASTM G-26 |

2. Posts

a. Wood: Oak or similar quality hardwood, 3.0 square inches cross-sectional area minimum.
b. Steel: Standard T or U section weighing 1.00 pound per linear feet minimum.

3. Mesh

a. 14-1/2 gauge minimum with 6 inch maximum mesh opening, plastic safety fence, orange or black, or as approved.

B. Prefabricated Units

1. Pre-assembled units meeting the material requirements of 2.5 A may be used in lieu of field assembled units.

2.6 CHEMICAL BINDER

A. Non-toxic conforming to Item 713-12 of NYSDOT Specifications.

2.7 RIP-RAP

A. Per NYSDOT Specifications.

2.8 FILTER STONE

A. Sound durable stone per NYSDOT Specification Section 703, size(s) per plans.

2.9 TURF REINFORCEMENT MATTING

A. VMAX Model SC250 UV-stable polypropylene permanent matting as manufactured by RollMax Rolled Erosion Control or approved equivalent.

1. 70% Straw Fiber / 30% Coconut Fiber.
2. Thread: Polypropylene UV Stable.
3. Thickness: 0.62 in.
4. Resiliency: 95.2%.
5. Density: 0.891 g/cm$^3$.
6. UV Stability: 100%.
7. Light Penetration: 4.1%.
8. Porosity: 99%.
9. Tensile Strength: 709 lbs/ft.
10. Elongation: MD=23.9% / TD=36.9%.

PART 3 - EXECUTION

3.1 GENERAL

A. **The contractor is responsible for completing all monitoring, and reporting as required throughout the duration of construction as required within the SWPPP, and provide reports to the Owner's Representative, and Engineer for acceptance.**

B. Contractor shall implement erosion control measures as indicated in the SWPPP, shown on the plans, as job conditions dictate, and to comply with the local municipality. Intent is to minimize erosion and pollutants at the source, capture sediment at regular intervals and prevent sediment intrusion into storm sewer pipes, structures, and waterways. Work includes, but is not limited to, hay bales, mulching, temporary silt fences, filter fabric, expeditious grading, stormwater diversion, prompt turf establishment, sediment dikes, and maintenance of same. **The contractor is responsible for controlling all runoff from the site during the period of construction.** If erosion control measures are not shown on the Plans, he will be instructed by the Engineer on where to implement them at no cost to the Owner.

B. The Contractor shall initiate stabilization measures as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. If disturbed soil surfaces are to be left exposed for a period of greater than 14 days, stabilize the soil with temporary seeding and/or mulch

to limit erosion. Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable. The onset of seasonally adverse weather shall not be used as an excuse for not implementing the necessary erosion controls. The Contractor shall use foresight in his activities to only disturb areas that he can stabilize before adverse weather conditions prevail. The Contractor is encouraged to schedule his work such that final land surface restoration closely follows initial disturbance to the maximum extent possible in order to limit bare soil exposure and dependence on the temporary systems discussed above.

C. Sediment shall be removed from sediment traps or sediment ponds whenever their capacity has been reduced by fifty (50) percent from the design capacity and/or as required to ensure intent. Prior to fine grading and restoration, the Contractor shall remove and dispose of accumulated sediments and silts as required.

## 3.2 AUTHORITY OF WORK

A. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow and fill operations and to require the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses/ waterbodies.

## 3.3 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Promptly repair equipment leaks. Provide equipment and personnel to perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

B. Notify Owner, Engineer and regulatory authority having jurisdiction if contaminated soil, groundwater or other form of pollution is encountered. Excavate and dispose of any contaminated earth immediately in accordance with Federal, State and local regulations off-site, and replace with suitable compacted fill.

C. Pollutants such as fuels, lubricants, bitumen's, raw sewage and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or man-made channels leading thereto. Wash water or waste from concrete mixing operations or trucks shall not be allowed to enter live streams.

## 3.4 STREAM CROSSINGS

A. Frequent forging of live streams will not be permitted; therefore, temporary bridges, or other structures, shall be used wherever an appreciable number of stream crossings are

necessary. Unless otherwise approved in writing by the Engineer, mechanized equipment shall not be operated in a live stream.

3.5 DEWATERING AND WASHWATERS

A. Water from aggregate washing, equipment washing, dewatering or other operations containing sediment, shall be treated by filtration, settling basin or other means sufficient to reduce the turbidity, so as not to cause a substantial visible contrast to natural conditions.

3.6 DIVERSION BERMS/SWALES

A. Slopes of significantly barren slopes exceeding 15 percent require special treatment such as water diversion berms/swales, straw bale sediment barriers, sodding, approved mulch tacking agent over straw mulch applied over seeded areas, or a combination thereof.

3.7 SILT FENCE INSTALLATION

A. A silt fence may be used subject to the following conditions:

1. Maximum allowable slope lengths contributing runoff to a silt fence are:

| Slope Steepness | Maximum Slope Length (Ft) |
|---|---|
| 2:1 | 50 |
| 3:1 | 75 |
| 4:1 | 100 |
| 5:1 | 150 |
| Flatter than 5:1 | 150 or as shown on the plans |

2. Maximum drainage area for overland flow to a silt fence shall not exceed ½ acre per 100 feet of fence.
3. Erosion would occur in the form of sheet erosion.
4. There is no concentration of water flowing to the barrier.

B. Woven wire fence to be fastened securely to fence posts with wire ties or staples.

C. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24 inches at top and mid-section.

D. Embed silt fence material a minimum of 6 inches below finished grade.

E. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded.

F. Maintenance shall be performed as needed and material removed when “bulges” develop

in the silt fence, or when 6 inches of sediment has accumulated against it, whichever occurs first. All sediment barriers shall be repaired or replaced when they no longer function as a barrier.

3.8 CONSTRUCTION OPERATIONS

A. When borrow material is obtained from other than commercially operated sources, erosion of the borrow site shall be so controlled, both during and after completion of the work so that erosion will be minimized and sediment will not enter streams or other bodies of water. Waste or disposal areas and construction roads shall be located and constructed in a manner that will minimize sediment-entering streams. Install sediment containment devices around stockpiles and waste areas. Stabilize the surface of temporary haul roads to minimize sediment creation.

B. Install stabilized construction entrances at all ingress/ egress points to local and state roads as required and as detailed on the plans.

3.9 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall take good quality photographs of streams, ditches, channels, ponds or other water bodies immediately adjacent to project work area that will receive runoff from construction activity. Document existing conditions such as existing sediment deposition, water turbidity, eroded streambed/ streambanks and condition of vegetation.

3.10 CONSTRUCTION SCHEDULE

A. Prior to beginning construction, the Contractor shall submit a detailed project schedule which outlines his program for controlling erosion, limiting conveyance of silt and sediment, pollution prevention, maintenance of devices/ controls, and restoration of graded surfaces for the duration of the project and the one-year warranty period, for review and acceptance.

B. The Engineer may limit the area of clearing and grubbing, excavation, trenching and embankment operations in progress, commensurate with the Contractor's capability, responsiveness, and progress in keeping the finish grading, mulching, seeding and other such permanent control measures current in accordance with the accepted schedule. Should season limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified per requirements of the SWPPP.

3.11 FINAL STABILIZATION

A. Final stabilization is defined as all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of at least 80% has been established or equivalent stabilization measures (such as the use of mulches or

geotextiles) have been employed on all unpaved areas and areas not covered by permanent structures per requirements of the SWPPP.

3.12 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

A. Remove erosion control devices when final stabilization has occurred for the respective areas of the site and are no longer needed.

3.13 CONTRACTOR'S RESPONSIBILITY

A. Contractors are responsible for the performance of their subcontractors and to ensure they properly comply with the Erosion Control Measures, where applicable.

B. The actual scheduling and implementation of Erosion Control Measures and Maintenance of required water quality is the responsibility of the Contractor(s). The erosion and sediment control plan and devices shown are considered to comprise the majority of efforts needed, but not necessarily all that will be required. Weather, site and unforeseen conditions can dictate that greater efforts will be necessary.

END OF SECTION 31 25 00

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SECTION 31 50 00

SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. This section covers wood and steel sheeting or soldier piles and lagging with internal bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to any methods of excavation support and underpinning which the Contractor elects to use to complete the work.

B. The Contractor shall furnish, place and maintain such sheeting, shoring, and bracing at locations necessary to support the sides of excavations to prevent danger to persons or damage to adjacent pavements, facilities, utilities, or structures; to prevent injurious caving or erosion or the loss of ground; and to maintain pedestrian and vehicular traffic as required by the Contract Documents, the Contractor's sequence of construction, and as required by the Engineer.

C. In all sheeting, shoring and bracing operations, care shall be taken to prevent collapse of excavations, injury to persons or damage to adjacent structures, facilities, utilities and services. Any injuries to persons shall be the responsibility of the Contractor; and any damage to the work occurring as a result of settlement, water or earth pressure, or other causes due to inadequate bracing or other construction operations of the Contractor shall be satisfactorily repaired and made good by the Contractor, at no additional expense to the Owner.

D. The Contractor shall comply with all federal, state, and local safety regulations and requirements.

E. Vibration monitoring shall be provided during installation and extraction of sheeting whenever the braced excavation is within 25 feet of existing structures, or as requested by the Engineer.

F. Routine monitoring of the in-place excavation support system shall be provided.

1.2 RELATED WORK:

A. Section 31 00 00, EARTHWORK

B. Section 31 23 19, DEWATERING

1.3 QUALITY ASSURANCE:

A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the New York State Department of Labor, Board of Standards and Appeals. Contractors shall be familiar with the requirements of these regulations.

B. The Contractor is responsible for the adequacy of the excavation support system and shall retain the services of a Professional Engineer registered in the State of New York to design

the required excavation support systems. The Contractor's Professional Engineer shall practice in a discipline applicable to excavation work, shall have experience in the design of excavation support systems and shall design in conformance with OSHA requirements. The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the excavation support system is installed and functions in accordance with his design. Criteria listed herein defining the responsibilities of the Contractor's Professional Engineer are minimum requirements.

1.4 REFERENCES:

The following standards form a part of this specification as referenced herein.

American Society for Testing and Materials (ASTM)

| | | |
|---|---|---|
| ASTM | A6 | General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use |
| ASTM | A328 | Steel Sheet Piling |

1.5 SUBMITTALS:

A. At least three weeks before starting installation of the excavation support system, the Contractor shall submit the attached Certificate of Design completed and signed by the Contractor and the Professional Engineer, identifying the Contractor's Professional Engineer who will be responsible for design of the excavation support system, and including, for record purposes only:

1. An overall time schedule for construction of the braced excavation system.

2. A description of the anticipated sequence of construction.

3. Three (3) copies each of:

a. Complete details of braced excavation methods, equipment and sizes and lengths of materials proposed to be used, and a plan showing the locations of all support of excavation systems relative to existing and proposed site features.
b. Details of vibration monitoring devices and reports.
c. Details of the means and methods that will be used in monitoring the integrity of the support system during its entire period of use to insure the safety of the excavation.
d. Complete computations for the design of the braced excavation system bearing the seal of the responsible Professional Engineer duly registered licensed to practice within a discipline applicable to excavation work, in the State of New York.
e. Any other pertinent data required for record purposes by the Engineer.

B. Receipt of the information by the Engineer will not relieve the Contractor of the sole responsibility for the adequacy of the braced excavation system, and for assuring that there will be no resulting damage to adjacent pavement, utilities or structures, and for providing safe conditions within the sheeted areas.

C. Further for the record, upon completion of the work of this section, the Contractor shall submit 3 copies of all records of survey, vibration monitoring and inspection of existing structures to the Owner's Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Timber sheeting shall be sound spruce, pine, or hemlock, and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2-inches thick.

B. Where steel sheet piling is indicated on the drawings or installation is ordered by the Engineer or required by OSHA standards, the material shall be of such size and strength as required by the excavation support design prepared and submitted by the Contractor's Professional Engineer. Steel sheet piling may be new or used material but shall not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength. Steel sheeting shall be an approved standard section, weighing not less than 22 pounds per square foot of wall and conforming to ASTM A6 and A328.

C. Where soldier piles and lagging are used, the steel piles shall conform to ASTM A6, and the lagging shall meet the requirements for timber sheeting, as defined above.

D. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design prepared and submitted by the Contractor's Professional Engineer. Timber or steel used for bracing shall be new or undamaged used material, which does not contain splices, cutouts, patches, or other alterations, which would impair its integrity or strength.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Work shall not be started until all materials and equipment necessary for construction are either on the site of the work or satisfactorily available for immediate use as required.

B. The sheeting/lagging shall be sufficiently tight to minimize any resulting lowering of the groundwater level outside the excavation, as required in Section 31 23 19, DEWATERING.

C. The sheeting/piling shall be driven by approved means to the design elevation. No ends or edges of sheeting/piling shall be left exposed in a manner, which could create a possible hazard to safety of the public or a hindrance to traffic of any kind.

D. Where sheeting is to be used, it shall be driven ahead of excavation operations to the extent practicable so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with thoroughly compacted Common Borrow or CLSM.

E. If boulders or very dense soils are encountered, making it impractical to drive a sheeting/piling section to the desired depth, the section shall be treated as directed by the Contractor's Engineer.

F. Within seven days of completing the initial installation of the earth support system, the Contractor shall submit a certification from his Professional Engineer, stating that the excavation support system as installed is in general compliance with the design or approved modifications thereto.

G. The sheeting/piling shall be left in place where indicated on the drawings or required by the Engineer in writing. At all other locations, the sheeting/piling may be left in place or salvaged at the option of the Contractor. Wood or steel sheeting/piling permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise required.

H. All cut-off material is the property of the Contractor and shall be promptly removed by it from the site.

I. The satisfactory construction and maintenance of the excavation support system, complete in place, shall be the responsibility of the Contractor.

J. The Contractor shall be responsible for promptly repairing all damage to adjacent structures caused by the installation, performance, or removal of the excavation support system.

END OF SECTION

(Certificate of Design follows this page)

CERTIFICATE OF DESIGN

RE: Contract between
OWNER: _____
and (Name)
CONTRACTOR: _____
on (Name)
CONTRACT: _____
(Title)
_____
(Number) (Date)

The undersigned hereby certify that the engineer listed below:

1. Is licensed or registered to perform professional engineering work in the state of _____;
(Location of Project)

2. Is qualified by education and training to design the _____

specified in Section _____ of subject contract;

3. Has previously designed comparable excavation support systems;

4. Has prepared the design in full compliance with the requirements of subject contract, including all applicable laws, regulations, rules, and codes; and

5. Will inspect and supervise installation of the excavation support system and will monitor the in-place system to confirm that the system is installed and functions in accordance with the design.

| CONTRACTOR | ENGINEER |
|---|---|
| By:_____ (Signature) | By:_____ (Signature) |
| _____ (Name) | _____ (Name) |
| _____ (Title) | _____ (Engineering Discipline) |
| _____ (Date) | _____ (Date) |

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# SECTION 32 10 00

# ROADWAY AND MISCELLANEOUS SUBBASE

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.2 WORK INCLUDED

A. Construction of roadway subbase and miscellaneous surface subbase (drives, parking, concrete walk), or as indicated on the Plans.

1.3 RELATED SECTIONS

Section 02 30 00: Soil Testing Services.
Section 31 22 13: Rough Grading.
Section 31 23 16: Trenching, Backfilling, and Compacting.
Section 32 12 16: Asphalt Concrete Paving, Surfacing and Striping.

Description of System: Roadway and miscellaneous surfaces subbase shall be constructed in all excavations within paved areas.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Comply with rules, regulations, laws concerning construction activity in roads of the applicable jurisdiction.
2. Comply with all other applicable regulations.

B. Testing Laboratory: As specified.

C. Reference Standards: NYSDOT Specs.

D. Comply with Geotechnical Report.

1.5 SUBMITTALS

A. Samples: Before using material for roadway or miscellaneous surface subbase, submit samples from each typical source to the testing laboratory and submit reports for approval as follows:

1. Submit six copies of the gradation analysis and compaction requirements for

material used.

a. Report from soils testing laboratory should state any special manipulation or compaction requirements required to achieve specified density or supportive value for all material.
b. Retesting of material compacted in place may be required at any time or place as required by the Engineer.

B. Manufacturer's Data: Geotextile.

1.6 PROJECT CONDITIONS

A. Notify Owner, Engineer, and Construction Manager at least 24 hours in advance of commencing the Work of this Section.

B. Existing Conditions: Subgrade should be dry and not spongy before commencing the Work of this Section.

C. Environmental Conditions: Do not commence the Work of this Section if subgrade is wet, frozen or covered with snow, or if forecasts predict such conditions within 8 hours.

1.7 SEQUENCING AND SCHEDULING

A. Schedule the Work of this Section to commence as soon as possible after:

1. Underground systems have been installed.
2. Subgrades have been established.
3. Subgrades have been proof-rolled.
4. Subgrades have been accepted.

PART 2 - PRODUCTS

2.1 All products shall be as shown on the Plans.

PART 3 - EXECUTION

3.1 Subgrades which are spongy or otherwise unacceptable during proof-rolling shall be dug out and filled with subbase material at no additional cost to the Owner. Failure to do so shall be at the Contractor's risk and cost.

3.2 Roadway and Miscellaneous Surface Subbase shall be spread in such depths that the maximum thickness of any layer, after compacting, shall be 6 inches. Water shall be added in such amounts in order to obtain satisfactory compaction.

3.3 Compaction shall be to 95% Modified Proctor density in accordance with ASTM D-1557

accomplished with either a smooth steel wheeled roller having a minimum weight of 10 tons, or a pneumatic tired roller having an operating weight of not less than 1000 pounds per tire.

3.4 Testing laboratory must inspect and approve subgrades and fill layers before further construction work is performed thereon. Refer to Section 02 30 00 – Soil Testing Services. If testing laboratory subgrade and/ or fill reports are below specified density, provide additional compaction at no expense to Owner.

END OF SECTION 32 10 00

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# SECTION 32 12 16

# ASPHALT CONCRETE PAVING, SURFACING, AND STRIPING

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED: Construction of two course pavements, pavement markings and pavement overlays at the locations shown on the drawings and as specified, including the running track.

1.3 RELATED SECTIONS

Section 31 11 00: Clearing and Grubbing.
Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling, and Compaction.
Section 32 10 00: Roadway and Miscellaneous Subbase.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Material Certifications: Contractor shall provide material certifications for all products and certify that all material items comply with or exceed specified requirements.

C. Compaction Tests: Contractor shall provide compaction test results for all products and certify that all tests comply with or exceed specified requirements.

## PART 2 - PRODUCTS

2.1 TRUING AND LEVELING (if required): These mixtures shall meet the requirements of New York State Department of Transportation (NYSDOT) Specification 401-2.02 Type 7 Top and Type 5 Shim, as thicknesses dictate.

2.2 TOP COURSE: This mixture shall meet the requirements of NYSDOT Specification 403.13 Type 6 Top. Asphalt content shall be between 6.0 and 8.0 percent. Thickness per plans.

2.3 BINDER COURSE: This mixture shall meet the requirements of the NYSDOT Specification 403.13 Type 3 Binder. Asphalt content shall be between 4.5 and 6.5 percent. Thickness per plans.

2.4 PAVEMENT MARKING PAINT: Chlorinated rubber-alkyd type, FS TT-P-115, Type III as follows:

A. White: DOT Specification Section 727-03. (1985)

B. Yellow: DOT Specification Section 727-04.

2.5 TACK COAT: NYSDOT approved, asphalt emulsion, material designation 702-90.

PART 3 - EXECUTION

3.1 Prior to placing pavements, ensure area to be paved matches all dimensions as indicated on Contract Drawings, and verify that surfaces to be paved have been properly prepared.

3.2 INTERFACE: Edges of existing bituminous pavement to be restored or extended shall be saw-cut in straight lines. Apply tack coat on edges before paving against. Appropriate time for tack coat to set varies with temperature.

3.3 An asphalt concrete truing and leveling course shall be placed at locations where the existing pavements require filling to provide a uniform surface upon which pavement resurfacing can be installed.

3.4 COMPACTION: Immediately after the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. All courses shall be initially rolled with the roller travelling parallel to the centerline of the pavement beginning at each edge and working toward the center. Banked curves shall be rolled starting at the low side edge and working toward the super-elevated edge. When the compaction procedure used by the Contractor fails to produce results acceptable to the Engineer, the procedure shall be adjusted to obtain the desired results. Rollers shall move at a slow and uniform speed. The roller drive roll or wheel shall be nearest the paver.

Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture as required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with small quantities of detergent or other approved material, but in no case shall a solvent having effect upon the bituminous pavement be used.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers as required to achieve compaction equivalent to compaction produced by the roller. On depressed areas, a trench roller or a small vibratory roller approved by Architect may be used. Cleated compression strips also may be used under the roller to transmit compression to the

depressed area.

Suitable means shall be provided to keep pavers and other equipment and tools free from bituminous accumulations. The surface of the pavement shall be protected from drippings of oil, kerosene, or other materials used in paving and cleaning operations.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be removed and replaced with fresh hot mixture, which shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of bituminous material shall be corrected to the satisfaction of the Engineer.

All bituminous concrete courses shall be initially rolled with an approved steel-wheel roller. The roller shall overlap the previous roller pass by one-half the width of the roller.

3.5 SURFACE TOLERANCE:

A. Grade: The contractor shall perform grade conformance tests (witnessed by the Owner's Representative) on both the binder course and the top course. Both surfaces should have positive drainage.

B. Planarity: After completion of the finish rolling operations on each course, the contractor shall test (witnessed by the Owner's Representative) the compacted surface with a 10-foot straightedge. Measurement shall be made perpendicular to and across all mats at a distance not to exceed 25 feet. The maximum allowable planarity deviation with a pass shall be 1/8 inch in 10 feet when measured in any direction. Variations exceeding the allowable tolerances shall be corrected at no additional cost to the satisfaction of the Engineer, including completely relaying the pavement if required. The general contractor shall be completely responsible for establishing this slope. Any areas not in compliance shall be corrected at the cost of the general contractor.

Material which is part of a truing or leveling course will not be considered in pavement thickness determinations.

3.6 TEMPERATURE: Bituminous concrete shall have a mixing and placing temperature range between 250°F and 325°F and shall be placed only when the roadway surface is 50°F or above and rising, or as required by Engineer.

3.7 Existing pavement shall be cleaned by the use of approved mechanical sweepers in a manner approved by the Engineer. Ruts and depressions below the general surface that are not adequately cleaned by the use of mechanical sweeper shall be cleaned by hand brooms to the Engineer's satisfaction. The pavement and shoulders, if applicable, shall be kept clean until the overlay operations are completed.

3.8 Potholes and areas that are determined by the Engineer to be in need of repair shall be cleaned of debris before the new pavement is placed, receive a tack coat, as specified and as required, and shall be filled with bituminous material, asphalt concrete Type 5.

3.9 TACK COAT EQUIPMENT: The Contractor shall provide a distributor for applying the tack coat. The distributor shall be designed, equipped, maintained and operated so that the tack coat can be heated and applied uniformly on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard. Distributor equipment shall include a tachometer, accurate metering device or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically.

Smaller power spray units of hand spray equipment will be permitted only in areas where the Engineer determines that the use of a distributor is impractical.

3.10 APPLICATION OF TACK COAT: The tack coat shall be uniformly applied by a pressure distributor to a prepared clean pavement immediately prior to the placing of the new overlay. Tack coat shall be applied as approved by the Engineer to offer the least inconvenience to traffic, to permit one-way traffic, where practical, to prevent pickup or tracking of the bituminous material.

Tack coat shall not be applied on a wet pavement surface or when the surface temperature is below 45 degrees Fahrenheit. The temperature and areas to be treated shall be approved by the Engineer prior to application. The application rate shall be 0.05 to 0.07 gallons per square yard as approved by the Engineer.

3.11 Prior to painting pavements, sweep clean all surfaces to remove loose material and dirt.

3.12 Apply paint with mechanical equipment to produce uniform straight edges without fogging. Apply two coats at manufacturer's printed recommended rates. Apply paint as specified in New York State Department of Transportation Specification Section 640.

3.13 Following painting, provide the necessary protective measures to properly cure the painted areas. Allow sufficient time for proper curing as per the paint manufacturer's printed recommendations.

END OF SECTION 32 12 16

# SECTION 32 13 13

# PORTLAND CEMENT CONCRETE PAVEMENT

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS

Section 31 23 00: Earthwork.
Section 32 10 00: Roadway and Miscellaneous Subbase.

1.3 WORK INCLUDED: Construct Portland Cement sidewalk slabs and miscellaneous items as shown on the plans or as indicated.

1.4 SUBMITTALS: Contractor shall submit design mixes for all concrete products intended for use. Also submit detailed plan and necessary drawings for the Landscape Architect/ Engineer's review and approval. Plan submitted shall indicate pour sequencing and incorporate specified time lag before pouring adjacent sections of concrete.

1.5 SPECIAL CURING REQUIREMENTS: The Contractor shall leave concrete forms in place a minimum of five (5) days after each pour. In addition, the Contractor shall moist cure the concrete during this period.

1.6 APPLICABLE MATERIAL AND INSTALLATION STANDARDS

A. American Society for Testing Materials:

1. Specification for concrete aggregates.
2. Method of test for soundness of aggregates by the use of sodium sulfate or magnesium sulfate.
3. Specification for ready-mix concrete.
4. Specification for Portland cement.
5. Air-Entraining Portland cement.
6. Test for scratch hardness of soft fragment particles.
7. Air-entraining admixtures for concrete.
8. Specification for preformed expansion joint fillers for concrete paving and structural construction (non-bituminous types).

B. American Concrete Institute:

1. ACI 318 Building Code Requirements for Reinforced Concrete.
2. ACI 604 Recommended Practice for Winter Concreting.
3. ACI 605 Recommended Practice for Hot Weather Concreting.
4. ACI 613 Recommended Practice for Selecting Proportions for Concrete.
5. ACI 614 Recommended Practice for Selecting Proportions for Structural Lightweight Concrete.
6. ACI 614 Recommended Practice for Measuring, Mixing and Placing Concrete.
7. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
8. ACI 544 Manual of Concrete Practices for Fiber Reinforced Concrete.

## PART 2 - PRODUCTS

2.1 CONCRETE:

A. 4500 PSI compressive strength concrete at the end of 28 days.

B. Air Content: 6% ± 1%, W/C, = 0.38, batch with high-range water reducer.

C. Slump: 4-6" with high-range water reducer.

D. Portland Cement: ASTM C150, Type 1, natural color. Minimum mix content 575 lbs/cy.

E. Fine Aggregate: ASTM C-33 except as noted below. Contain maximum of two percent (2%) by weight of the following: shale, schist, alkali, earth, loam, mica, coated grains, soft and flaky particles. No more than four percent (4) clay by volume. 95% pass No. 4 sieve. Less than 3 percent (3%) pass No. 100 sieve.

F. Coarse Aggregate: Crushed quarried stone, ASTM C-33. Aggregate Size No. 57.

2.2 WATER: Clean and free from oil, acid and injurious materials and amounts of vegetable matter, alkalis, and other salts.

2.3 WATER REDUCING AGENT: Shall be listed on the current approved list of the NYSDOT Materials Bureau.

2.4 AIR ENTRAINING AGENT: Shall be listed on the Current Approved List of the NYSDOT Materials Bureau.

2.5 Non-shrink grout shall be "EMBECO" as manufactured by Master Builders.

2.6 CONCRETE FORMS: Wood or metal designed to support concrete at time of placement, reinforcing, placement equipment and personnel involved during pouring and finishing operations. Form design shall provide for leak-proof joints. Include bracing and shoring

required to prevent deflection of joints.

2.7 FORM TIES

A. Exposed Concrete: Plastic cone snaptie, similar and equal to Superior's Type 3M; with Superior's 1 inch concrete plugs, color to be selected.

B. Unexposed Concrete: Snap-off metal ties, designed to prevent form deflection, and prevent spalling surfaces upon removal. Portion remaining after removal shall be at least 1 inch from concrete surface.

2.8 FORM COATINGS: Commercial formulation form-coating compounds shall not bond with, stain, nor adversely affect concrete surfaces, and shall not impair subsequent treatments, nor impede wetting of surfaces to be cured with water or curing compound.

2.9 EXPANSION JOINT MATERIAL: 1/2" thick ASTM D994 pre-molded expansion joint filler strips; full slab depth, except top portion shall be removable after concrete placement to accommodate sealant placement.

2.10 JOINT SEALANT

A. Premium grade, high performance, moisture cured, one component, polyurethane base, non-sag elastomeric sealant.

B. Federal Specification TT-S000230C, Type II, Class A.

C. Sikaflex 1A, as manufactured by the Sika Corporation, or approved equivalent.

2.11 CURING SHEET MATERIAL: ASTM C-171.

2.12 BACKER ROD: Sonofoam polyethylene foam by Sonneborn, or approved equivalent, unless otherwise instructed by the sealant manufacturer.

2.13 WELDED WIRE FABRIC: As indicated on Drawings

## PART 3 - EXECUTION

3.1 The Contractor shall coordinate and schedule an independent testing laboratory 24 hours in advance of any concrete pours. The Contractor shall employ and pay for services for an independent testing laboratory to perform specified inspection and testing. It shall be the responsibility of the Contractor to schedule the concrete testing laboratory to be on site during all concrete pours. Reschedule planned concrete pours as necessary to ensure the on-site presence of the concrete testing laboratory. Caution: No concrete shall be installed without on-site testing by the concrete testing laboratory. The Contractor shall

not be entitled to additional compensation for concrete which cannot be incorporated into the work due to the failure to schedule and have a concrete tester on site. The Contractor's independent testing laboratory shall be approved by the Landscape Architect and Construction Manager.

3.2 MIX PROPORTIONING

A. The responsibility for selection of proportions to be submitted to meet the NYSDOT Specification shall be that of the concrete supplier.

B. The proportions of ingredients shall be such as to produce a mixture which can be satisfactorily placed and consolidated by the methods to be employed.

3.3 PRODUCTION

A. Ready Mixed Concrete: Except as otherwise provided in these specifications, ready mixed concrete shall be batched, mixed, and transported in accordance with "Specifications for Ready Mixed Concrete" (ASTM C-94).

B. Mixing Water Control:

1. Concrete which arrives at the site with slump below that suitable for placement may be adjusted by the addition of water to increase slump provided that the maximum slump is not exceeded. Any addition of water to increase slump shall be followed by mixing of at least 30 revolutions of the drum.
2. After adjustment to the proper slump, discharging shall be allowed for as long as the concrete retains its workability without the addition of water.

3.4 INSTALLATION

A. Forms:

1. Forms, cores, molds, etc. shall be constructed so that the finish concrete will conform to the shapes, lines, grades, and dimensions indicated on the drawings. All forms shall remain in place for a minimum of 120 hours after completion of all concrete work, including finish work.
2. Slots, chases, recesses, inserts, keys and temporary openings:

a. Box out for all slots, chases, recesses, or openings as shown on the drawings and as required by the work of all other trades.
b. Build bulkheads with keys in walls and footings for stopping concrete. Keys shall be clean, reused or new chamfered 2 x 4's.
c. Box out for all temporary openings such as shafts, pipe spaces, etc., and build forms to seal up when and as required.
d. Build into concrete all inserts, anchors, PVC or metal reglets, ties, hangers,

collars, sleeves, thimbles, sockets, nailing blocks, miscellaneous and ornamental iron as required to secure the work of other trades.

e. General - Ample opportunity and full cooperation shall be given to the various trades and other contractors to install their required embedded items. Suitable templates or instructions, or both, will be provided for setting such items as are not placed in the forms by the trades themselves. Openings in floor slabs shall be provided for pipes, ducts, etc., prior to or at the time of placing the form work. All embedded items shall be subject to inspection by the Landscape Architect. Engineer before concrete is placed.

B. Preparation for Placing Concrete:

1. Notify the Engineer 24 hours in advance of the beginning of the following stages of work:

   a. Final grade for slab bearing.
   b. Pouring concrete slabs, foundations or walls.
   c. Schedule date and time of pour with Owner's concrete testing laboratory.

2. Remove water from excavations or forms before depositing concrete. Divert any water flow through proper side drains. Remove without washing over freshly deposited concrete, debris, foreign materials from form interiors, from mixing, conveying equipment inner surfaces.
3. Provide runways or other means for wheeled equipment to convey concrete to deposit points. Do not wheel equipment used to deposit concrete over reinforcement. Do not support runways on reinforcement.
4. Spray existing concrete surfaces with water to a surface saturated condition prior to pouring concrete.

C. Placing Concrete:

1. Re-tempered concrete shall not be allowed. Air-slaked or lumpy concrete shall not be used. The contents of the mixer shall be completely discharged before each new batch is loaded.
2. In form work, spade or vibrate thoroughly to ensure contact with concrete. Tamping shall be done with an internal mechanical vibrator. Vibrators shall not be used to move or flow concrete.
3. No honeycombed work will be accepted.
4. Vertical and/ or horizontal plumb bulkheads with keys shall be used at joints (locations shown on plans) for ending day's work and arranged at right angles to planes of stress and in areas of minimum shear. Provide waterstop(s) where watertightness is required as shown on the plans. Watertightness is required for structures designed to contain fluid.
5. Concrete shall be placed in lifts not to exceed 18 inches.
6. Continuous vibration shall be used with the interval of insertion not to exceed 18

inches in any direction.

7. Placing shall be performed so as to prevent the forming of cold and/or irregular joints.
8. No free fall of concrete over 4'-0" will be permitted.
9. Maximum concrete pours shall be as follows:

   Slabs: 25' maximum dimension, 600 sq. ft. maximum area, maximum length to width ratio of 2.

   Walls: 30' adjacent concrete shall not be placed for a period of five (5) days, unless otherwise indicated. Note requirements for leaving forms in place under paragraph 3.4.

3.5 CONSTRUCTION JOINTS, CONTROL JOINTS AND EXPANSION JOINTS

A. All joints shall be formed and caulked joints made at such locations shown on plans as will least impair the strength of the structure, and as may be required by the Landscape Architect/ Engineer.

B. Furnish and install keying and supplementary reinforcement at each construction joint and stoppage. Install waterstops as shown on plans, as required for watertight structures or as required by Landscape Architect/ Engineer.

C. Before pouring next section, clean exposed reinforcement, clean and roughen exposed concrete and slush with neat cement grout.

D. Install expansion joint material at all locations where new concrete is cast against existing structures, walls, etc. Install expansion joints at 20' intervals within all new walks and as shown on the Contract Drawings, other than the above noted structures, walls, etc.

E. Construct control joints, in slabs, at the locations shown on the drawings or at 5 foot intervals in each direction.

3.6 TOLERANCES

A. Unless otherwise indicated, all concrete work to be faced with other materials shall have a tolerance not to exceed 1/4" as measured on a ten-foot straight edge.

B. If any concrete varies beyond tolerances indicated, Contractor may be required to grind it down at no extra cost. Ground surface may require surface treatment. Provide required treatment as ordered by Landscape Architect/ Engineer at Contractor's expense.

3.7 PATCHING CONCRETE

A. Immediately after removal of forms, patch all holes including those at form ties,

honeycombing, and other voids in concrete surfaces. Remove all fins and other projections on concrete surfaces.

B. Wet the surface to be patched and patch with stiff mortar of one part Portland cement to two parts sand. All exposed surfaces: The cement portion shall be one part white Portland and one part regular cement. Sand shall pass #30 sieve. Permit patching grout, before use, to set 20 to 30 minutes and re-temper without adding additional water.

C. Compact mortar thoroughly into place and screed it off a little higher than adjacent work and finish flush after initial set.

D. Work that cannot be properly patched, in the opinion of the Landscape Architect/ Engineer, shall be rejected.

3.8 SLABS ON GRADE

A. Construct structures as shown on the drawings. Include all material, forms, etc. required.

B. Compacted porous fill shall be placed before installing concrete slabs which bear on the ground. See applicable specifications and details on plans. Place vapor barrier over gravel base as shown on plans.

C. Upon the prepared base, place a monolithic concrete slab, reinforced as indicated.

3.9 CONCRETE FINISHING

A. No concrete finishing operation shall be conducted while there is free water on the surface, and no dusting of cement, sand or cement-sand mixture is to be used to dry up the surface water on the concrete. Power finishing tools may be used except that area adjacent to electrical trench header ducts, vertical surfaces, electrical fittings, etc. shall be hand finished.

B. All concrete slabs shall be, after finishing, true and level to within 1/8" of 10' unless indicated to have drainage slopes. Remedial action at the Contractor's expense may be required, at the Landscape Architect/ Engineer's discretion, for any slab not meeting the above standards.

C. Should spalling occur in surface of concrete, the slab shall be removed and replaced at the Contractor's expense. Patching surface of the concrete after initial set has taken place will not be accepted.

3.10 SPECIFIC SLAB FINISHES

A. All slabs shall receive the following preliminary finish:

1. Bring the concrete to the correct level and, at the proper times, screed, darby and float with a magnesium float. Additional operations shall be applied as indicated.

B. Broom Finish (Final): Provide a medium broom finish or as noted on the plans, where broom finish is scheduled.

C. Trowel Finish (Final): All other slab surfaces: Immediately following floating, steel trowel, steel trowel a second time at the proper time for a dense, hard surface.

## 3.11 PROTECTION AND CURING

A. General:

1. The following rules are for the minimum requirements of protection only and the Contractor shall remain fully responsible to produce concrete which has not been weakened or injured on the surface by frost or freezing or by incomplete protection during hot weather.
2. Protection shall consist of heating the materials, fully enclosing the concrete, and maintaining the temperature of the enclosure at not less than 50° F. for five (5) days.
3. Aggregates and water shall be heated to not more than 140° F. and the concrete shall not be less than 50° F, nor more than 90° F. when deposited.
4. Contractor shall provide adequate protection during hot weather against rapid drying and cold joints. Accelerating, retarding, or anti-freeze admixtures will not be permitted. Provide facilities necessary for moist curing.
5. Prevent use of concrete for a period of five (5) days after installation.
6. Forms shall be left in place a minimum of 120 hours after completion of each pour.

B. Cold Weather Concreting:

1. When placing concrete at or below a temperature of 40° F., or whenever atmospheric temperatures will probably fall below this limit within the next 24 hours and after placing concrete, the mixing water and aggregates shall be heated and the freshly placed concrete protected by adequate housing or covering and heating.
2. The Contractor shall have on the job ready to install adequate equipment for heating the materials and for maintaining the proper temperatures and atmospheric moisture for the freshly placed concrete, and for enclosing the work in accordance with the requirements specified herein. Do not use salamanders or open fires. Submit diagrams showing type of equipment to be used and how it will be placed in order to maintain proper temperatures required during cold weather concreting for approval of the Landscape Architect/ Engineer.
3. Either aggregates or water or both, as may be necessary, shall be heated with steam coils or other approved devices so that the average temperature of the concrete as it is deposited in a form shall fall within the limits specified herein. Aggregates

containing frozen lumps shall be independently heated and no materials containing frozen lumps, ice or snow shall be allowed to enter the mixer.

4. Before placing the concrete in any form or on any surface, or around any reinforcement, heat shall be applied in such manner that ice or snow will be completely removed and the reinforcement will be at the same temperatures as the concrete being placed. No concrete shall be placed on a subgrade that is frozen or on one that contains frozen materials.
5. Concrete, when placed in the forms, shall have a temperature of not less than 70° F. and not above 80° F. Freshly placed concrete shall be maintained at a temperature of not less than 50° F. for five (5) days for normal concrete, and not less than 50° F. for three (3) days for high early strength concrete. Cooling of the concrete to outside temperatures shall not be at a rate faster than one (1) degree each hour for the first day, and two (2) degrees each hour thereafter.
6. The use of salts, chemicals, or other foreign materials in the mix to lower the freezing point of the concrete is prohibited.
7. Before concreting any section of a structure, the section shall be completely housed or enclosed in a manner that will ensure the maintenance of the specified temperatures. The housing shall be left in place for the curing period specified except that sections may be temporarily removed as required to accommodate the placing of column forms or concrete provided that they are replaced immediately after the form or concrete is in its final position.
8. A permanent temperature record shall be kept showing the date, hour, outside temperature, and temperatures at several points within the enclosure to show the most favorable and unfavorable condition to which the concrete is subjected. Thermometer readings will be taken at the start of the work in the morning and again in the late afternoon and the data so obtained shall be recorded in such manner that it will show the location of each reading and any conditions which might have an effect on the temperature. A copy of the temperature records shall be furnished to the Landscape Architect/ Engineer upon request.

C. Hot Weather Concreting:

1. Hot weather, for the purposes of this specification, shall be defined as 80° F. and rising, or 85° F. and falling.
2. During hot weather, Contractor shall plan for prompt placement by assuring an adequate number of personnel to handle and place concrete, and he shall provide adequate protection during finishing and during operations.
3. Forms, reinforcing subgrade should be sprinkled with cold water just prior to concrete placement.
4. Concrete with a temperature exceeding 90° F shall not be placed and an attempt shall be made to keep the concrete temperature well below 90° F. Contractor shall check the temperature of concrete just prior to placement and after placement. This information shall be recorded together with the location that the particular concrete was placed.

5. Cooling of concrete materials before mixing and during mixing using methods as recommended by the American Concrete Institute shall be adhered to.
6. Concrete shall be placed as soon as possible after mixing and/or delivery. On flat work, all finishing operations should be conducted promptly.
7. Protection and Curing: Exposed surfaces shall be protected from accelerated drying by using continuous water curing methods and surfaces shall be kept moist for at least 120 hours. On flat slab or other work exposed to wind or other evaporate conditions, surfaces shall be protected by wet sand or sisal-kraft paper. If water is used directly on new surfaces, the temperature of water should not be much cooler than the concrete.
8. Test of concrete conducted during hot weather shall be in accordance with latest ACI and PCA Standards and/or recommendations.
9. During hot weather, a log shall be kept indicating air temperature, weather condition, relative humidity, and temperature of concrete before and after placement. These tests shall be conducted at frequent intervals and as required by the Landscape Architect/ Engineer.
10. Admixtures to delay setting time will not be permitted.

D. Curing:

1. Concrete shall be protected against loss of moisture, rapid drying, or temperature changes, mechanical injury, or injury from rain or flowing water for a period of seven (7) days. Concrete shall be maintained above 50° F., and in a moist condition during curing period.
2. Curing shall commence as soon as free water has disappeared from the surfaces after finishing. Curing of formed soffits of beams, girders, floor slabs, and similar surfaces shall be accomplished by moist curing with forms for full curing period.
3. Except where specified methods of curing are specified, curing may be accomplished by any one of the following methods:

    a. Moist Curing: Surfaces shall be kept continuously wet by covering with burlap, mats, or sand, thoroughly saturated with water and covering kept wet by spraying or hosing. Place materials to provide complete surface coverage and lap all joints minimum 3 inches.
    b. Impervious-Sheeting Curing: Surfaces shall be thoroughly wetted with a fine spray of water and then covered with waterproof paper, polyethylene sheeting, or polyethylene coated waterproof paper. Edges and ends of sheeting shall be overlapped not less than 4" and securely cemented or taped to form a continuous cover. Sheeting shall be weighted down to prevent displacement and shall be repaired or replaced if torn, damaged, or removed during curing period. Under this curing method, the surface of the concrete shall at all times be covered with a water film. Spray concrete surface periodically to ensure that at no time will concrete cure under "dry" conditions.

4. Concrete curing of exposed floor slabs shall incorporate one of the two methods described above. Use of a concrete cure, seal agent is not acceptable for curing of exposed floor slabs or sidewalks. Use of this product for sealing and/or curing in other locations may be allowed at Landscape Architect/ Engineer's discretion.

3.12 CONCRETE TESTING STANDARDS (Testing Provided by Owner)

A. American Society for Testing Materials:

1. Method of making and curing concrete compression and flexure test specimens in the field.
2. Method of test for compressive strength of molded concrete cylinders.
3. Method of test for securing, preparing and testing specimens from hardened concrete for compressive and flexural strengths.
4. Method of test for weight per cubic foot, yield, content (gravimetric) of concrete.
5. Method of test for slump of Portland cement concrete.
6. Standard method for sampling fresh concrete.
7. Method of test for air content of freshly-mixed concrete by the volumetric method.
8. Method of making and curing concrete compression and flexure test specimens in the laboratory.
9. Method of test for air content of freshly mixed concrete by the pressure method.

3.13 CONCRETE TESTS

A. During the progress of the work, compression test specimens shall be made and cured in accordance with the "Standard Method of Making and Curing Compression and Flexure Test Specimens in the Field" (ASTM Standard C-31). Not less than five specimens (2 for 7 day, 2 for 28 day tests and one spare specimen) shall be made for each test, nor less than one test for each 50 cubic yards of concrete of each class or fraction thereof placed in one day. Specimens shall be cured under laboratory conditions. Except that when, in the opinion of the Landscape Architect/ Engineer, there is a possibility of the surrounding air temperature falling below 40° F., and he may require additional specimens to be cured under job conditions. Cost for laboratory tests for compression test cylinders shall be borne by the Contractor.

B. Specimens shall be tested in accordance with the standard method of test for compressive strength of molded cylinders (ASTM Standard C-39).

C. Slump tests shall be conducted for each individual concrete batch or as frequently as may be required to assure that no concrete shall have more than the required slump. All tests shall be conducted in the presence of the Landscape Architect/ Engineer or his representative. Tests shall be performed in accordance with ASTM requirements. Tolerance is ±1/2".

D. Entrained air tests for air-entrained concrete shall be conducted every hour and/or as

frequently as may be required to assure that the concrete shall contain the air content specified. All tests will be conducted in the presence of the Landscape Architect/ Engineer or his representative, and testing of each batch will be made by the same representative of the testing laboratory. Take tests at point of placement for pumped concrete.

E. All cylinders, air content test, and slump tests shall be made by qualified personnel acceptable to the Landscape Architect/ Engineer.

F. The standard age test shall be 28 days, but 7-day tests may be used provided that the relation between 7-day and 28-day strengths of the concrete is established by tests for materials and proportions used. In the event that 28-day tests fall below the compressive strengths called for in the specifications, the spare test cylinder shall be broken at 56 days as a final check.

G. If the average strength of the laboratory-cured field cylinders for any portion of the structure falls below the compressive strengths called for in the specifications, the Engineer may require tests in accordance with the "Standard Methods of Securing, Preparing, and Testing Specimens of Hardened Concrete for Compressive Flexural Strength" (ASTM Standard C-42) or order load tests to be made on the portions of the building so affected. Costs for hardened concrete tests and load tests shall be borne by the Contractor.

H. If the average strength of the laboratory-cured field cylinders falls below the compressive strength called for, the concrete covered by these tests shall be assumed as inadequate for the structure and the Landscape Architect/ Engineer may require that load tests be placed on the portions of the structure in question. Loading shall be in accordance with Section 203 of the ACI Building Code Requirements for Reinforced Concrete, and the method of loading and conducting the test shall be submitted in advance to the Engineer for his approval. If the tested portion of the structure does not fulfill the requirements of the test, it shall be deemed to have failed and shall be removed and replaced. The Engineer reserves the right to reject sub-standard concrete work as indicated by hardened concrete field cylinders regardless of the load tests.

I. The laboratory shall furnish copies of all tests as follows:
   Construction Manager.....1 copy
   Landscape Architect/ Engineer.....1 copy
   General Contractor.....2 copies
   Concrete Supplier.....1 copy

J. At the end of the week, the Contractor shall submit to the Landscape Architect/ Engineer a record showing the results of all slump and air tests made during the previous week. This record shall indicate the location in the project where this particular concrete was used.

3.14 EVALUATION AND ACCEPTANCE

A. Evaluation: Test results of standard cylinders, molded, cured and tested according to ASTM C-31 and C-39, shall be evaluated separately for each concrete mix according to the "Recommended Practice for Evaluation of Compression Test Results of Field Concrete" (ACI 214).

B. Acceptance: The criteria for acceptance of concrete shall be detailed in "Building Code Requirements for Reinforced Concrete" (ACI 318, Chapter 4, Paragraph 4.3).

END OF SECTION 32 13 13

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# SECTION 32 30 00

# SITE IMPROVEMENTS

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

Provide site improvements in the locations shown or as described herein, complete with anchorages and associated site work.

1.3 RELATED SECTIONS

Section 31 23 00: Earthwork.
Section 32 13 13: Portland Cement Concrete Pavement.
Section 32 31 13: Chain Link Fencing.

1.4 SUBMITTALS

A. Contractor shall submit catalog information on site improvements for review by Engineer.

## PART 2 - PRODUCTS

2.1 FLAGPOLE

A. Flagpole shall be Model #ESS30B51-02 as manufactured by American Flagpole or approved equivalent. Flagpole shall include:

1. Clear Anodized Ball (90065-003).
2. Standard Spun Collar (94508-003).
3. Cleat Cover – Cylinder Lock (Lock and Keys included) with 9” HD Alum. Cleat (96016)
4. #10 Braided Polypropylene Halyard.
5. Mounting Height shall be 30’.
6. Butt Dia. – 5”
7. Top Dia. – 3”
8. Wind Speed w/ Flag – 75 mph
9. Wind Speed w/o Flag – 95 mph

2.2 PICNIC TABLE

A. 8’ A-Frame Recycles Plastic Picnic Table Model No. H-2564C as manufactured by ULINE or approved equivalent.

   1. Color: Cedar.
   2. Top: Recycled Cedar
   3. Dimensions: 96”L x 61”W x 30”H

PART 3 - EXECUTION

3.1 Equipment shall be permanently installed in concrete anchorages or surface mounted per manufacturer’s specifications.

3.2 Any site improvement materials which are constructed of steel and not galvanized or factory coated with a finish system shall be painted in the field in accordance with "Painting and Finishes" specifications. Colors as noted above.

END OF SECTION 32 30 00

# SECTION 32 31 13

# CHAIN LINK FENCING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of 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. Complete construction of all chain link fences, gates, and appurtenances, as indicated on the Plans and specified herein after.

B. Related Sections include the following:

1. Section 01 33 00: Submittals.
2. Section 32 10 00: Portland Cement Concrete Pavement.

### 1.3 SUBMITTALS

A. Product Data: Material, descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Show locations of fence, each gate, posts, rails, and tension wires and details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, gate swing and other required installation and operational clearances, and details of post anchorage and attachment and bracing.

C. Product Certificates: Signed by manufacturer of chain-link fences and gates certifying that products furnished comply with requirements.

D. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. (Minimum 5 years experience). Source Limitation for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.5 PROJECT CONDITIONS

A. Notify Owner and Architect at least 24 hours in advance of commencing the Work of this Section.

B. Existing Conditions: Ground should be dry and not spongy before commencing the Work of this Section. Rock may be encountered during footing excavation and shall be removed to the specified depth at no additional cost to the Owner.

1.6 SEQUENCING AND SCHEDULING

A. The Work of this Section should not commence until the following are complete.

1. Underground systems have been installed.
2. Subgrades have been accepted.

B. Set concrete at posts so top of concrete is at finished grade. Crown top for drainage. Footing excavation to be clean utilizing an auger.

PART 2 - PRODUCTS

2.1 FABRIC

A. Woven into a 2" diamond mesh in which the individual pickets are helically woven and interwoven in the form of a continuous chain link fabric.

1. Fabric shall be galvanized steel and black vinyl coated.
2. Fabric Wire Gauges: (Core Wire Gauge)

a. 6 gauge.

B. Selvage: Knuckled at both selvages.

2.2 LINE POSTS

A. Line posts shall be galvanized Class B steel tubing, sized meeting the requirements of heavy duty commercial fencing. Posts to be galvanized steel and black vinyl coated.

B. Of sufficient length to allow for installation to a depth of no less than four feet below finished grade. (Footing depth to be five feet below finished grade).

2.3 TERMINAL, CORNER, GATE AND PULL POSTS

A. End, corner and pull posts shall be Class B galvanized steel tubing, sized meeting the requirements of heavy duty commercial fencing. Posts to be galvanized steel and black vinyl coated, of sufficient length to allow for a depth of no less than four feet below finished grade.

B. Gate posts shall be galvanized steel class B and conform to the following;

| **Gate Leaf Single Width** | **Post Sizes** |
|---|---|
| 6' & less | 4" OD Schedule 40 |
| 6' - 12' | 4" OD Schedule 40 |
| 12' - 19' | 6-5/8" OD Schedule 40 |

2.4 POST TOPS

A. Tubular post tops shall be galvanized steel, black vinyl coated and so designed as to exclude moisture from the posts.

2.5 TOP RAIL/BOTTOM RAIL

A. The fence shall have a continuous top and bottom black vinyl coated steel rail for its full length of 1-5/8" O.D. galvanized tubing weighing 1.35 lbs. per lineal foot as per U.S. Government Specification RR-F-191/3B. The top and bottom rail shall pass through openings provided in the line post tops and each length shall be coupled with an internal swaged sleeve for a distance of 3". The fabric shall be attached to the top and bottom rail by means of double wrapped 13 (.091") gauge tie wires spaced at intervals of approximately 24". (All components to be galvanized and vinyl coated).

2.6 TRUSS BRACES

A. For fences with fabric over 6' high, a brace rail of 1-5/8" O.D. galvanized steel tubing weighing 1.35 lbs. per lineal foot, along with a 5/16" steel truss rod and turnbuckle attachment shall be installed between terminal, corner and gate posts and each adjacent line post. (All components to be black vinyl coated).

2.7 TENSION BARS, BANDS AND FITTINGS

A. For fences using square terminal posts, fabric shall be attached to the square post by means of a tension bar held in place by specially designed clips. When pipe gate posts are used, fabric shall be attached to these posts by means of bands and tension bars. The fabric shall be attached to "C" section line posts by coated steel ties at intervals not to exceed 15". (All components to be black vinyl coated).

2.8 GATES

A. Gate frames shall be constructed of 2" square galvanized steel tubing joined at the corners by specially designed corner fittings. Internal bracing shall be 1-1/4" square steel tubing. The fabric shall be attached to the frame on all four sides by means of special hook connectors and tension rods. All gates shall be equipped with galvanized steel hinges, latch, and gate holdbacks. Latch shall be forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch. Double gates shall be equipped with a drop bar. (All components to be black vinyl coated).

2.9 CAST-IN-PLACE CONCRETE

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C 150 aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.

1. Concrete Mixes: Normal-weight concrete air entrained with not less than 4000-psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.

2.10 GROUT AND ANCHORING CEMENT

A. Non-shrink, Non-metallic Grout: Premixed, factory-packages, non-staining, non-corrosive, non-gaseous 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 Metal fence posts shall be set plumb and the tops of the posts shall be brought to a smooth grade line. All metal fence posts shall be set in 4,000 psi concrete.

3.2 Metal fence post spacing and location shall be as follows: line posts shall have 10 foot spacing to location equidistant on the fence line. End posts shall be at the last point in the fence line and at gates. One brace assembly per end post is required. Corner posts shall be at changes of direction of 30 degrees or greater and two brace assemblies are required. Pull posts shall be at 500 foot spacing, at ends, corners, and abrupt changes in direction or grade. Two brace assemblies are required per pull post.

3.3 Concrete post foundations shall be cast clean in the ground (auger cut) and around the posts and the top surface shall be domed one inch above grade to shed water, provide a neat appearance when completed. Posts shall be set in holes in sizes as indicated on the plans. Terminal posts shall have braces of the quantity previously specified herein. These braces shall be securely fastened to the line posts and terminals by brace bands, rail ends, nuts and bolts. The top rail shall pass through the loops of the line post caps to form a continuous brace end-to-end of each stretch of fence. Top rail links shall be joined with rail couplings.

3.4 The fabric shall be secured to all terminal posts with stretcher bands fastened to the posts with stretcher bands spaced at a maximum of 14 inches. The fabric shall be tensioned during the installation procedure to give a reasonably taunt completed fence. If any of the galvanized materials specified under this item have protective coating damage to the extent that effectiveness to prevent erosion of the base materials is impaired, the Engineer will require the Contractor to repair such parts at no additional cost by applying two coats of approved material.

3.5 Gates shall be installed per 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. Adjust gate as required to operate smoothly, easily and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.

END OF SECTION 32 31 13

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# SECTION 32 31 14

# CANTILEVERED SLIDING GATE

## PART 1 - GENERAL

### 1.1 WORK INCLUDED:

A. The work in this section shall include furnishing all labor, materials, equipment, and appliances necessary for the installation of two (2) complete, motorized, cantilever slide gate systems as shown on the plans, or as required by the Engineer.

B. The General Contractor shall be responsible for supplying and installing the entire gate system including, but not limited to, gate, all required conduit, and control wiring between the operator and gate components, proximity reader and corresponding transponders, entrapment protection devices, loop detectors, cantilever slide gate, and installing the power to the gate controllers and access controls at the gate, which will be controlled by the transponders and from inside the building (location TBD).

C. The Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques required.

D. Components (operator from one source and gate panel from another) assembled at the job site to form a system will not be approved.

### 1.2 REFERENCES:

A. The following standards form a part of this specification, as referenced:

American Society for Testing and Materials (ASTM)

ASTM F2200 Standard Specification for Automated Vehicular GateConstruction

ASTM F1184 Standard Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class 2

American Welding Society (AWS)

AWS D1.2 Structural Welding Code

Underwriters Laboratory

UL 325 Gate Operator Requirements

1.3 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. PRODUCT DATA:

1. Provide manufacturer's catalog cuts with printed specifications and installation instructions.
2. Deliver two copies of operation and maintenance data covering the installed products. Manual shall include parts lists showing manufacturer's names and part numbers for the gate operator.

B. SHOP DRAWINGS:

1. Supply shop drawings showing the relationship of operating systems with gate components, including details of all major components & control systems (including panel inside the building).
2. Include complete details of gate construction, gate height, and post spacing dimensions.

1.4 WARRANTY:

A. The cantilever slide gate and operator system shall be warranted by the manufacturer against manufacturing defects for a period of (3) three years from date of sale. The truck assembly shall be warranted against manufacturing defects by the manufacturer for a period of (5) five years from date of sale.

1.5 PRODUCT HANDLING AND STORAGE:

A. Upon delivery at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

## PART 2 - MATERIALS

2.1 MANUFACTURER:

A. The cantilever sliding gate system shall conform to Fortress TYM-2000 Heavy Duty Gate System (s) as manufactured by Tymetal Corp., Greenwich, NY, an equivalent gate system manufactured by Ameristar Fence Products, Inc., Tulsa, OK, or approved equal.

2.2 CANTILEVER SLIDE GATE:

A. Gate width:

1. Heavy Duty Gate may be used for clear openings up to 30' wide.

a. Site has (2) slide gates, each with a clear opening of 18’.

B. Heavy Duty Gate Frame:

1. The gate frame shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3"x5" aluminum structural channel/tube extrusion weighing not less than 3.0 lb/lf. To maintain structural integrity this frame member shall be "keyed" to interlock with the “keyed” track member. If fabricated as a single horizontal piece, the bottom member shall be a 2"x5" aluminum structural tube weighing not less than 2.0 lb/lf. If fabricated in two horizontal pieces, the bottom member shall be a 5" aluminum structural channel weighing not less than 2.6 lb/lf. When the gate frame is manufactured in two horizontal pieces or sections, they shall be spliced in the field (the gate frame shall be fabricated in one or multiple sections depending on size requirements or project constraints).

2. Vertical Members:

a. The vertical members at the ends of the gate frame shall be “P” shaped in cross section with a nominal base dimension of no less than 2”x2” and weighing not less than 1.6 lb/lf. Major 2”x2” vertical members weighing not less than 1.1 lb/lf shall separate each bay and shall be spaced at less than gate height intervals.
b. Intermediate 1”x2” vertical members weighing not less than 0.82 lb/lf shall alternate between 2”x2” major members.

C. Heavy Duty Gate Track:

1. The gate frame shall have a separate semi-enclosed “keyed” track, extruded from 6005A-T61 or 6105-T5 aluminum alloy, weighing not less than 2.9 lb/lf. The track member is to be located on only one side of the top primary. Welds are to be placed alternately along the top and side of the track at 9" centers with welds being a minimum of 2".

D. All welds on the gate frame shall conform to Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 Structural Welding Code. All individual welders shall be certified to AWS D1.2 welding code.

E. Gate Mounting:

1. The heavy duty gate frame is to be supported from the track by two (2) swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies.
2. The structural gate frame is to be supported from the track by four (4) swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies.
3. The bottom of each support post shall have a bracket equipped with a pair of 3” UHMW guide wheels Wheel cover protectors shall be included with bottom guides to comply with UL325.
4. Gap protectors shall be provided and installed, compliant with ASTM F 2200-05.

F. Diagonal Bracing:

1. Diagonal "X" bracing of 3/16” minimum diameter stainless steel aircraft cable shall be installed throughout the entire gate frame.

G. The gate shall be completed by installation of approved filler as specified.

1. Chain Link: 2”x2”x9 gauge black PVC coated steel chain link fabric shall extend the entire length of the gate (if operated gate, counterbalance must also have fabric to prevent reach through and comply with ASTM F 2200) Fabric shall be attached at each end of the gate frame by standard fence industry tension bars and tied at each 2”x2” vertical member with standard fence industry ties. ASTM F2200 requires attachment method that leaves no leading or bottom edge protrusions (cannot exceed 0.5 inch).

H. Posts:

1. For the heavy duty gate, a single set of support posts shall be minimum 4" O.D. round Schedule 40 or 4”x4”x3/16” wall square steel tubing, grade 500. Gate posts shall be galvanized or coated and supported in concrete footings as specified by thedesign team.

I. Finish:

1. Gate to color coated with polyester powder black. The gate (including track member) and all accessories shall be pretreated chemically by sand blasting or other acceptable method to ensure proper coating adherence.

2.4 SLIDE GATE OPERATOR:

A. The gate operator shall meet power requirements listed on E-series drawings and be designed and sized according to each individual gate shown on the drawings.

B. The gate operator includes an APeX Controller with integrated radio receiver, plug-in loop detector capability, surge protection, and easy to read labeling standard.

C. Capacity:

1. The gate operator shall be rated to operate a gate weighing up to 2000 lbs.

D. The gate operator shall be UL 325 compliant for Class I, II, III, and IV.

E. Design Criteria:

1. Operation shall be by means of a 1 horsepower single phase instant reversing motor, transferring power to a four inch diameter pulley, to a right angle oil bath gear reducer

using another four inch diameter pulley and V-belt. Power is then transferred through a sliding collar disconnect system to the output drive shaft equipped with a #40 drive sprocket and roller chain which attaches to the gate with heavy-duty gate attachment brackets. Intermediate chain supports with anti-catch design shall also besupplied.

2. The operator shall open the gate at a rate of approximately 11 inches per second.
3. The #40 chain shall be coated with "Armor Coat" corrosive resistant chain coating. Corrosive resistance exceeds nickel plating.

F. Components:

1. Standard mechanical components shall include as a minimum.

    a. 3/16 inch thick, weather resistant UV-stabilized polyethylene one piece cover, which is fully removable and lockable.
    b. Heavy-duty, plated frame with mounting legs for pad mounting standard.
    c. Pedestal to raise operator from ground level and protect from high water.
    d. 20:1 right-angle oil bath gear reducer.
    e. Arctic package with immersion heater.
    f. One inch solid steel output drive shaft.
    g. Spring loaded manual disconnect.
    h. Steel "critter" plate to prevent entry of ground pests.

2. Standard electrical components shall include as a minimum:

    a. 1 HP motor with thermal overload protection in 208 VAC single phase.
    b. Solid state logic controls featuring 15 diagnostic L.E.D. indicators and auto-close timer (1 second to 9 minutes).
    c. Inherent, fully adjustable motor over-current sensing to detect obstructions via precision 24 turn potentiometer, with separate adjustments for opening and closing directions.
    d. Controller housed in zinc plated control box with separate box provided for connection of field power.
    e. Power On/Off switch.
    f. Contacts for opening, closing and reversing accessories, as well as contact and non-contact obstruction sensing devices. 24 VAC and 24 VDC available on terminal strip to power accessory devices, provided by non-circuit board mounted transformer with minimum 40VA rating.
    g. Four adjustable limits with precision snap-action type limit switches to control gate position, mounted inside a separate four switch limit box.
    h. Master/slave or standalone capable with dip switch selection. Three wire twisted pair shielded cable required.

G. Access Control:

1. Entry:

a. The cantilevered sliding gate shall be controlled by two methods of access – key pad and transponder receiver (fob) . The key pad shall be mounted on a gate manufacturer furnished dual height pedestal. Mounting heights shall be reviewed and approved by the Village of Ardsley prior to installation. Pedestals shall be securely fastened in the ground with a concrete foundation as recommended by the manufacturer and shall be designed to accept conduits internally.
b. Gate manufacturer shall provide 12 corresponding transponders (fobs) for operation of the gates.

2. Exit:

a. A free exit loop (loop detector) shall be embedded in pavement on the secure side of the gate opening and shall function as the primary exit/egress device. Contractor will be required to coordinate with the Village of Ardsley regarding the final location of these loop detectors. Installation of ground loop shall include saw cutting, installation and replacement of pavement.

3. Reversing Devices:

a. A reversing loop (loop detector) shall be embedded in pavement on the unsecure side of the gate opening.
b. Photoelectric through beams/photo eyes shall be installed to span the clear opening and gate path at the tail section.
c. Miller reversing/sensing edges shall be installed on the leading and trailing edges of the gate panel.

4. Gate controls shall have override capabilities to allow the Village of Ardsley to open the gates andkeep them open if needed.
5. The system shall be capable of manual override during power outage.
6. The system shall be capable of adjusting the length of time the gate remains open once the transponder has been scanned before it begins to close.

H. Factory Inspection and Testing:

1. Manufacturer shall test each operator at factory to assure smooth, quiet operation.
2. Manufacturer shall test all control inputs to ensure proper function.
3. Manufacturer shall certify that operator has been tested as part of a complete gate system in excess of 50,000 cycles.

## PART 3 - EXECUTION

### 3.1 SITE INSPECTION:

A. Examine final grades and installation conditions.

B. Work shall not commence until all unsatisfactory conditions are corrected.

3.2 INSTALLATION:

A. Install equipment of this section in strict accordance with the company's printed instructions unless otherwise shown on the contract drawings.

B. The gate and installation shall conform to ASTM F 1184 standards for aluminum cantilever slide gates, Type II, Class 2.

C. The gate system is to comply with ASTM F 2200 and UL 325.

D. Obstruction Sensing Systems:

1. The inherent motor current sensors are part of the gate operator system and may not be removed or bypassed.
2. The installing contractor shall be responsible to ensure that appropriate external secondary entrapment protection devices be installed for the specific site conditions to protect against all potential entrapment zones. Proper operation of these safety devices shall be verified and training as to the operation and maintenance of these devices for the users and owners shall be documented.

3.3 SYSTEM ACCEPTANCE AND VALIDATION:

A. Acceptance Test:

1. Test each system function.
2. Supply all equipment necessary for system adjustment and testing.

B. Test and Explain Safety Features:

1. Each system feature and device is a separate component of the gate system.
2. Read and follow all instructions for each component.
3. Ensure that all instructions for mechanical components, safety devices and the gate operator are available for everyone who will be using the gate system.
4. The warning signs shipped with the gate operator must be installed in prominent position on both sides of the gate.

C. System Validation:

1. The complete system shall be adjusted to assure it is performing properly.
2. The system shall be operated for a sufficient period of time to determine that the system is in proper working order.
3. Ensure the owner is clear with regard to the safety points concerning the basic operational guidelines of the safety features of the gate operator system. These safety points

are listed in the operator manual and must be read prior to system use.

4. Installer and customer shall complete Operated Gate System Installation Checklist (see operator manual).

3.4 CLEANING:

A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

END OF SECTION 32 31 14

# SECTION 32 32 23

# SEGMENTAL RETAINING WALLS

## PART 1 - GENERAL

### 1.1 RELATED WORK

Section 31 00 00: Earthwork
Section 32 13 13: Portland Cement Concrete Pavement

### 1.2 DESCRIPTION

A. This work shall consist of providing the Retaining Wall Systems in accordance with these specifications and with the design, lines, grades, and dimensions shown on the contract drawings.

B. Contract Drawings show a Retaining Wall designed and stamped by a professional engineer for this project. If the wall is constructed as shown, a design submittal is not required.

### 1.3 SUMMARY

A. This Section includes furnishing all materials and labor required for the design and construction of a precast concrete modular block (PMB) gravity retaining wall without geosynthetic reinforcement. Precast modular block retaining wall blocks under this section shall be cast utilizing a wet-cast concrete mixture, exhibit a final handling weight in excess of 1,000 pounds (450 kg) per unit, and may utilize concrete reinforcing steel.

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.

## 1.4 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.

## 1.5 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, 8th and 9th Edition.
   b. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-16.
   c. International Building Code, 2018 Edition.
   d. Design Manual for Segmental Retaining Walls, National Concrete Masonry Association, 3rd 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 D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.
f. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft (2,700 kN-m/m)).
g. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.
h. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
i. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).
j. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
k. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
l. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
m. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
n. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
o. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.
p. ASTM D4972 – Standard Test Method for pH of Soils.

q. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
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.

## 1.6 SUBMITTALS

A. Product Data. At least 14 days prior to construction, the General Contractor shall submit 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 Part 2.1, Paragraph 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: The Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the RWIC, per Part 1.07, Paragraph A of this section.

C. Retaining Wall Design Calculations and Construction Shop Drawings. Prior to construction, the General Contractor shall furnish construction shop drawings and the supporting structural calculations report to the Owner for review and approval. Unless specifically requested by the Owner, the submittal may be in electronic format. This submittal shall include the following:

1. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications by a Registered New York State Professional Engineer.
2. Qualifications Statement of Experience as specified in Part 1.07, subparagraph B of this section.
3. Certificate of Insurance as specified in Part 1.06, Paragraph B of this section.

1.7 CONSTRUCTION SHOP DRAWING PREPARATION

A. The RWDE 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 RWDE 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.
5. Information pertaining to the magnitude, location, and nature of surcharge loadings acting on or near the proposed wall.

B. The RWDE 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 RWDE 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 RWDE shall determine the appropriate standard(s) to be utilized, and to which the precast modular block design shall be based upon, except as noted herein. Refer to Part 1.03, Paragraph C, Part 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 Part 1.03, Paragraph A of this section.

H. Soil Shear Parameters. The RWDE 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 RWDE 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 in the approved standards, as determined by the RWDE, as referenced in Section 1.06, Part F. The minimum recommended factors of safety shall be as follows, or as otherwise selected as appropriate by the RWDE:

| | |
|---|---|
| Normal Service (static) | 1.3 to 1.5* |
| Seismic | 1.1 |
| Rapid Drawdown (if applicable) | 1.2 |

*High uncertainty/variability, wall supporting critical or sensitive facilities: 1.5, low uncertainty/variability, wall not supporting critical or sensitive facilities: 1.3

K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology, or NCMA Allowable Stress Design (ASD) methodology as determined by the RWDE as referenced in Section 1.06, Part F.

1.8 QUALITY ASSURANCE

A. RWIC Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the RWIC shall document compliance with the following:

1. Experience:

a. Construction experience with a minimum of 3,000 square feet (280 square meters) of the proposed precast modular block retaining wall system.
b. Construction of at least three (3) precast modular block (large block) retaining wall structures within the past three (3) years.
c. Construction of at least 5,000 square feet (465 square meters) of precast modular block (large block) retaining walls within the past five (5) years.

2. RWIC 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 used
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 RWIC must submit documentation demonstrating competency in precast modular block retaining wall construction through a training program that is deemed acceptable by the Owner.

B. RWDE Qualifications and Statement of Experience. The RWDE shall submit a written statement affirming that he or she has the following minimum qualifications and experience.

1. The RWDE shall be licensed to practice in the jurisdiction of the project location.
2. The RWDE 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. The project geotechnical engineer may provide global stability analysis.
3. The RWDE 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 RWDE shall affirm in writing that he or she has designed a minimum of approximately 3,000 face square feet (280 face square meters) of modular block earth retaining walls within the previous five (5) 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.

1.9 QUALITY CONTROL

A. The Owner's Representative shall review all submittals for materials, design, RWDE qualifications and the RWIC 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 and bearing capacity parameters specified by the RWDE.
3. Verify that the shear strength of the in-situ soil assumed by the RWDE 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 RWIC of any deficiencies in the retaining wall construction and provide the RWIC a reasonable opportunity to correct the deficiency.
7. Notify the General Contractor, Owner and RWDE 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 500 square feet (45 square meters) (in plan) per 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 RWIC of responsibility to construct the proposed retaining wall in

accordance with the approved construction shop drawings and these specifications.

E. The RWIC shall inspect the on-site grades and excavations prior to construction and notify the RWDE and General Contractor if on-site conditions differ from the elevations, assumptions, grading, and soil and groundwater conditions depicted in the retaining wall construction shop drawings.

1.10 DELIVERY, STORAGE AND HANDLING

A. The RWIC shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

B. The RWIC 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: 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: 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 - PRODUCTS

2.1 SEGMENTAL RETAINING WALL UNITS

A. Manufacturer: Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, or approved equivalent.

B. Solid Gravity Wall Block Collection as manufactured by Red-Rock or approved equivalent:

1. Texture: Limestone; Color: Natural
2. Dimensions: Varies
3. Setback: Per manufacturer's recommendations

C. All units shall be wet-cast precast modular retaining wall units conforming to ASTM C1776.

D. 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.

E. 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:

| **Freeze Thaw Exposure Class(1)** | **Minimum 28-Day Compressive Strength(2)** | **Maximum Water Cement Ratio** | **Nominal Maximum Aggregate Size** | **Aggregate Class Designation(3)** | **Air Content(4)** |
|---|---|---|---|---|---|
| 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 ($Cl^-$) Content in Concrete, Percent by Weight of Cement(5,6)** | | | | | 0.15 |
| **Maximum Chloride as $Cl^-$ Concentration in Mixing Water, Parts Per Million** | | | | | 1000 |

| **Maximum Percentage of Total Cementitious Materials By Weight [7,9] (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[8] | 50 |
| Total of Fly Ash or Other Pozzolans and Silica Fume[8] | 35 |
| **Alkali-Aggregate Reactivity Mitigation per ACI 201** | |
| **Slump (Conventional Concrete) per ASTM C143**[10] | 5 inches +/- 1½ inches (125 mm +/- 40 mm) |
| **Slump Flow (Self-Consolidating Concrete) per ASTM C1611** | 18 inches – 32 inches (450 mm – 800 mm) |

[1]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.
[2]Test method ASTM C39.
[3]Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.
[4]Test method ASTM C231.
[5]Test method ASTM C1218 at age between 28 and 42 days.
[6]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.)
[7]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.

[8]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.
[9]Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.
[10]Slump may be increased by a high-range water-reducing admixture.

F. 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) |
| 52” (1320 mm) XL Block | Height | 36” (914 mm) | +/- 3/16” (5 mm) |
| | Length | 46-1/8” (1172 mm) | +/- 1/2” (13 mm) |
| | Width* | 52” (1320 mm) | +/- 1/2” (13 mm) |
| 72” (1830 mm) XL Block | Height | 36” (914 mm) | +/- 3/16” (5 mm) |
| | Length | 46-1/8” (1172 mm) | +/- 1/2” (13 mm) |
| | Width* | 72” (1830 mm) | +/- 1/2” (13 mm) |
| 96” (2440 mm) XL Block | Height | 36” (914 mm) | +/- 3/16” (5 mm) |
| | Length | 46-1/8” (1172 mm) | +/- 1/2” (13 mm) |
| | Width* | 96” (2440 mm) | +/- 1/2” (13 mm) |

* Block tolerance measurements shall exclude variable face texture

G. Individual block units shall have a nominal height of 18 inches (457 mm), or 36 inches (914 mm) for XL blocks.

H. 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 interface 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.

I. In certain configurations and/or combinations of blocks, some minor on-site trimming/partial removal of some of the shear knobs may be necessary to allow for proper alignment.

J. 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.

K. 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).

L. The precast modular block units shall be manufactured with integrally cast shear knobs that establish 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:

| 18-inch High Blocks: | | | 36-inch High Blocks: | |
|---|---|---|---|---|
| | | | | |
| Horizontal Set-Back/Blk. Course | Max. Facing Batter | | Horizontal Set Back/Blk. Course | Max. Facing Batter |
| 3/8” (10 mm) | 1.2˚ | | 3-1/4” (83 mm) | 5.2˚ |
| 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.

M. 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.

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 outside of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the Owner.

## 2.2 LEVELING PAD

A. Material for leveling pad shall consist of one of the following:

1. Subbase Course Type 2.
2. Item B-12.

## 2.3 DRAINAGE AGGREGATE

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 D6913:

| U.S. Standard Sieve Size | % Passing |
|---|---|
| 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 |

B. Extend the drainage aggregate layer a lateral distance of one (1) foot beyond the wall's back, and extend to a height that is 8 inches below the finished grade.

2.4 REINFORCED BACKFILL

A. Reinforced Backfill Material: Selected Fill Material.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Prior to the performance of any excavations, the alignment of the wall shall be staked and offset stakes set by a land surveyor.

B. Verify location of existing structures and utilities prior to excavation. Ensure all surrounding structures are protected from the effects of wall excavation.

C. Excavate to the lines and grades shown on the project grading plans. Take precautions to minimize over-excavation.

D. The Owner's Representative will inspect the excavation and approve prior to constructing the wall's leveling pad.

E. Over-excavated areas in front of wall face shall be filled with compacted Selected Fill material, unless directed otherwise.

3.2 CONSTRUCTION OF BASE LEVELING PAD

A. Extend the leveling pad laterally at least a distance of 6 inches beyond the perimeter of the lowest wall unit.

B. Place leveling pad to the lines and grades shown on the Contract Drawings.

C. Compact leveling pad in accordance with the 90 percent density specification for Subbase Course Type 2 or Item B-12.

D. Prepare leveling pad to ensure full contact with the base surface of the segmental units.

3.3 RETAINING WALL UNIT INSTALLATION

A. Install segmental retaining wall per manufacturer's recommendations.

## 3.4 PLACEMENT OF BACKFILL

A. Place and compact backfill in lifts not exceeding eight (8) inches. Compact each lift in accordance with the 95 percent density specification.

B. Use only lightweight hand-operated equipment within 3 feet from the backside of the concrete units.

C. At the end of each day's operation, slope the last lift of reinforced backfill away from the wall units to direct runoff away from the constructed portion of the wall.

## 3.5 CONSTRUCTION MONITORING

A. Construct walls and perform compaction testing only when monitored or witnessed by the Owner's Representative.

END OF SECTION 32 32 23

# SECTION 32 91 13

# SOIL PREPARATION AND SOIL MIXES

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. Work Included in this Contract:

1. Screening, spreading and amending native topsoil as required from on-site stockpiles.
2. Furnishing topsoil from an off-site source, screening, and spreading, if needed.
3. Seed bed preparation.

B. Related Sections:

Section 02 30 00: Soil Testing Services.
Section 31 23 00: Earthwork.
Section 31 11 00: Clearing and Grubbing.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 31 25 00: Sediment and Erosion Control.

### 1.2 QUALITY ASSURANCE

A. Testing Laboratory: Provided by Contractor. Refer to Section 023000.

B. Reference Standards:

1. NYSDOT Specifications.
2. ASTM F 2396 Standard Guide for Construction of High Performance Sand-Based Rootzones for Athletic Fields.
3. United States Golf Association Recommendations for a Method of Putting Green Construction.

### 1.3 SUBMITTALS

A. Certificates: Manufacturers' or suppliers' certification that content of materials meets specification requirements.

1. Fertilizer.
2. Lime (if required).
3. Off-site topsoil.
4. Compost.
5. Peat/Organic Matter
6. Root Zone/Bedding Sand.

B. Test Reports: Supply Soil Testing Reports for topsoil (onsite & offsite) and sand to be used for athletic fields. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility testing shall be undertaken:

1. At source;
2. Upon arrival to site. (One test per every 500 cubic yards).
3. Immediately following spreading on site. Soil sampling shall also indicate if specified soil was supplied uniformly to the minimum specified depth.

1.4 DELIVERY, STORAGE AND HANDLING

A. Fertilizer and lime: Deliver to site in unopened, undamaged containers.

B. Store fertilizer and lime materials so they are protected from all forms of moisture such as rain, snow, surface drainage, ground water, condensation, etc.

C. Do not use wet, mildewed or caked material.

1.5 PROJECT CONDITIONS

A. Environmental requirements: Do not prepare or place frozen soils or soils in a muddy condition. Do not spread topsoil on frozen or muddy subsoil.

B. Protection: Protect other parts of this Contract from damage.

PART 2 - PRODUCTS

2.1 MATERIAL-TOPSOIL

A. Native topsoil: from on-site stockpiles.

1. General Lawn Areas: Screen topsoil to meet the following gradation:

| SIEVE SIZES | PERCENT PASSING BY WEIGHT |
|---|---|
| 2 inch | 100 |
| 1 inch | 85 to 100 |
| 1/4 inch | 65 to 100 |
| No. 200 Mesh | 20 to 50 |

B. Off-site topsoil:

1. The surface layer of dark colored humus soil, free from refuse, any material toxic to plant growth, subsoil, woody vegetation, stumps, roots, brush, stones, clay lumps or similar objects larger in greatest dimension than specified below. Sod and herbacious growth such as grass and weeds shall be thoroughly broken up and

mixed with the soil.

2. pH: between 5.5 and 7.6.
3. Organic content: Not less than 6 % or more than 12%.
4. Gradation:
   70 – 85% Sand: with 50% of content being medium or coarse.
   10 – 15% Silt
   5 – 10% Clay

## 2.2 AMENDMENTS

A. Lawn Fertilizer: Available nutrients, percent by total weight.

1. 9 nitrogen-at least 50 % from organic source.
2. 23 phosphorus.
3. 14 potassium.
4. Must contain a pre-emergent crabgrass control.

B. Limestone: Ground limestone with a minimum total neutralizing value of 88 % calcium carbonate equivalence, minimum 90 % passing the 20 mesh sieve and minimum 60 % passing the 100 mesh sieve.

C. Compost: Compost shall contain organic matter or material of a generally humus nature capable of sustaining the growth of vegetation, with no "foreign" matter (i.e. glass, plastic, etc.) or material toxic to plant growth. It shall be free from stones, lumps or similar objects larger than two inches in greatest diameter, roots, and brush. Composts that have been derived from organic wastes such as food and agriculture residues, animal manures and sewage sludge that meet the above requirements and are approved by the State Environmental Agency are acceptable compost sources.

Compost for USE ON TURF shall have the following properties:

| Parameters | Range |
|---|---|
| pH | 6.5 - 7.5 |
| Moisture content | 35% - 55% |
| Particle Size | <1/2" |
| C:N ratio | 15 - 30:1 |
| Organic Content | >40% |
| Bulk Density | <1,000 lbs./ cubic yard |
| Foreign Matter | <1% (dry weight) |

D. Peat or Organic Matter: Peat material shall be of a standard brand free of sticks, stones, hay or any other deleterious matter, and meet the following requirements:

| Parameters | Range |
|---|---|
| Total Ash | 15% or less |
| pH | 6.5 to 7.5 |

| | |
|---|---|
| % Moisture | 30% to 50% |

| SIEVE SIZES | PERCENT PASSING BY WEIGHT |
|---|---|
| No. 10 Mesh | 95 to 100 |
| No. 20 Mesh | 95 to 98 |

E. Water: Water used during the installation, "grow-in", and maintenance period shall be provided and paid for by the Contractor. The Athletic Field Contractor shall be responsible for appropriate water application. Water utilized shall be suitable for irrigation and free from ingredients harmful to plant life.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Examine areas to receive soil preparation to assure work of other trades has been completed.

B. Remove jute mesh, staples, hay bales and other erosion control measures in the line of work.

C. Completely disc subsoil that has become compacted and re-grade to required subgrade.

D. Verify that all subsoils are positively drained and free of ponded areas and debris.

E. Perform topsoil analysis for pH with recommendations for adjustment to specified pH limits.

F. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

A. If the subsoil has become overly compacted after discing, in the opinion of the Engineer, just prior to placing the topsoil, the subsoil material shall be scarified to a minimum depth of 3 inches so as to ensure a proper bond between the subsoil material and the topsoil.

B. Screen topsoil to remove particles larger than 3/4".

### 3.3 INSTALLATION

A. Topsoil:

1. Spread topsoil on all disturbed areas within Contract Limit Lines to a depth of 6 inches as shown on plans.
2. Import topsoil if stockpiled topsoil is insufficient to attain specified depth.
3. Fine rake topsoil to break up lumps and remove stones, debris, and foreign material one inch or larger in any dimension, and to establish a smooth uniform surface.
4. Final grades shall not vary more than one-tenth of a foot from elevations shown on Contract Drawings.
5. No unsightly variations, bumps, ridges, or other depressions which will hold water shall be acceptable.

B. Fertilization:

1. Apply fertilizer at a rate of 500 pounds per acre, or roughly 11.5 pounds per thousand square feet to all topsoil.
2. Lightly work fertilizer into the topsoil.

C. Liming:

1. Based on laboratory analysis and recommendations. Adjust pH of all areas to be between 5.5 pH and 6.5 pH, as follows:

| | |
|---|---|
| Existing pH, less than 4.0 | 170 lbs./1000 SF |
| 4.1 - 4.5 | 155 lbs./1000 SF |
| 4.6 - 5.0 | 125 lbs./1000 SF |
| 5.1 - 5.5 | 95 lbs./1000 SF |

D. Compaction:

1. Exercise extreme caution in all topsoil areas that soil is not overly compacted.
2. Soil that has become overly compacted, in the judgment of the Architect, shall be re-worked to achieve a satisfactory condition at no additional cost.
3. Topsoil on sloped areas may be lightly rolled to prevent erosion if application of seed is delayed.

## 3.4 CLEAN-UP

A. Immediately clean up spills of soil and conditioners on paved and finished surface areas.

B. Remove debris and excess materials from project site.

## 3.5 STOCKPILES

A. Hydroseed excess topsoil remaining in stockpiles. Do not remove excess topsoil from Owner's property. Coordinate with school on spreading out excess topsoil, prior to hydroseeding.

END OF SECTION 32 91 13

# SECTION 32 92 00

# LAWNS

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Application of seed and mulch by broadcasting.

B. Application of seed and mulch by mechanical means.

C. Application of seed and mulch by hydroseeding.

D. Establish dense lawn to the satisfaction of the Landscape Architect.

E. Repair all unestablished lawns.

1.3 RELATED SECTIONS

Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling and Compaction
Section 32 91 13: Soil Preparation and Soil Mixes.

1.4 QUALITY ASSURANCE

A. Reference Standards: NYSDOT Specifications.

B. Source Quality Control: Producer's tests for purity and germination of seed, dated within nine months of application.

1.5 SUBMITTALS

A. Manufacturer's or supplier's certification that materials meet specification requirements.

B. Certification of grass seed from seed vendor for each grass-seed 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 sod, identifying sod source including name and telephone number of supplier. (where applicable)

2. Certification by product manufacturer that the following products supplied comply with requirements:

   a. Limestone.
   b. Fertilizers.

C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of Landscape Architect/ Owners, and other information specified.

D. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.

   1. Analysis of existing surface soil.
   2. Analysis of imported topsoil.
   3. Analysis of pH of subbase soil and topsoil, (Native and/or Imported).
   4. Analysis of chemical composition of subbase soil and topsoil.

E. Planting schedule indicating anticipated dates and locations for each type of planting.

F. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment. The installer shall have specific experience with the installation of athletic field sod.

   1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that grass planting is in progress.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Landscape Architect’s satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Topsoil and subbase soil analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

   1. Report suitability of topsoil for lawn growth and sod growth. State recommended

quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil capable of supporting growth of lawns.

2. Testing shall be performed at a rate of one (1) test per ten thousand (10,000) square feet for lawns and athletic fields.

1.7 DELIVERY, STORAGE AND HANDLING

A. Seed, Hydroseed Mulch and Binder: Deliver to site in unopened, undamaged containers.

B. Store materials so they are protected from all forms of moisture such as rain, snow, surface drainage, ground water, condensation, etc.

C. Do not use wet or mildewed materials.

D. Sod: Deliver to site undamaged. Sod should not be stored on site for longer than 24 hours. While sod is stored on site, water as needed to prevent sod from drying out. Upon delivery, unload sod and lay flat to allow for uniform watering and maintenance.

1.8 PROJECT CONDITIONS

A. Existing Conditions: Apply seed only after preceding work affecting ground surface is complete.

B. Environmental Requirements:

1. Do not apply seed when soil is in a frozen, muddy or overly compacted condition.
2. Do not apply seed when wind exceeds 5 mph.
3. Time of seed application:

a. August 15 through September 30.
b. April 1 through May 15.
c. These periods may be extended or reduced according to prevailing weather conditions, upon approval by the Landscape Architect.

C. Protection: Restrict foot and vehicular traffic from seeding areas after application of seed and mulch until the end of establishment period.

1.9 MAINTENANCE

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days after date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance

during next planting season.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Sodded areas which die shall be replaced with new sod.

1. Replant bare areas with same materials specified for lawns.
2. Add new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches.

1. Lay out temporary lawn-watering system and arrange watering schedule to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly seeded, plugged, or sprigged areas.
2. Water lawn at the minimum rate of 1 inch (25 mm) per week.

D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent 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 following grass height:

1. Mow grass to a height of 2 inches when the overall height reaches 3 to 4 inches.

E. Post-fertilization: Apply fertilizer to lawn after first mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb. per 1000 sq. ft. of lawn area.

## PART 2 - PRODUCTS

2.1 Seed: Fresh, clean, new crop seed, weed content not exceeding 0.03 percent. It shall conform to Federal and State Standards. Each type of seed in the mixture shall meet or exceed the minimum percentage of purity and germination listed for that type of seed.

2.2 Mulching shall consist of paper or wood cellulose fibers, processed to contain no growth- or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of the materials application. The mulch material shall be supplied in packages having a maximum gross weight of 100 pounds. The mulch will have a maximum 10% moisture content, air dry weight basis.

2.3 The binder material shall be a biodegradable type as manufactured under the trade names of TERRATACK or CURASOL or equal. The manufacturer's suggestions for storage, mixing, and application shall be strictly adhered to and the Landscape Architect may sample the binder for testing purposes at any time. Other binders may be used if it can be demonstrated to the Landscape Architect's satisfaction that they are at least equal to the binders mentioned in all respects.

2.4 Straw mulch shall be stalks of oats, wheat, rye or other acceptable herbaceous growth that is free of noxious weeds. Materials that are low grade and unfit for farm use, such as "U.S. Sample Grade" will be acceptable. Hay will not be used.

2.5 Chemical Binder: Conform to Item 713-12 of Reference Standards.

2.6 All water used shall be potable.

2.7 FERTILIZER

A. 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-form, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts of starter fertilizer recommended in soil reports from a qualified soil-testing agency to facilitate plant growth. Fertilizer shall have a ratio of 1 part nitrogen; 2 parts phosphorous; 1 part potassium, and shall be 12-24-12 or comparable fertilizer.

2.8 MIXES

A. Seed:

1. Seed shall be a mixture of the species specified mixed in the proportion as listed below:

a. "Lawn Mix" (Lawn Mix A) (For use on lawn areas & site restoration)

| SPECIES | PERCENT BY WEIGHT | GERMINATION | PURITY |
|---|---|---|---|
| Rebel II or Rebel III Tall Fescue (or equivalent) | 30 | 95% | 80% |
| Relient Hard Fescue (or equivalent) | 15 | 95% | 80% |
| Baron Kentucky Bluegrass (or equivalent) | 25 | 85% | 75% |

| | | | |
|---|---|---|---|
| Palmer II or Prelude II Perennial Ryegrass (or equivalent) | 30 | 95% | 85% |

B. Tall Fescue variety shall provide heat and drought tolerance and produce leaves which are up to 30% finer and 188% denser than the standard Kentucky 31 Tall Fescue.

C. Perennial Ryegrass variety shall provide heat and drought tolerance and produce a leafy turf-type, fine textured, low growing turf of a dark green color.

D. Hard Fescue variety shall produce dark green, fine textured turf under minimal maintenance, especially where the use of fertilizer is discouraged or banned.

E. That portion of the above mixtures listed as inert and other shall consist of non-viable seed, chaff, hulls, live seeds of crop plants and harmless inert matter.

F. All seed mixtures shall be mixed by the vendor and shall be delivered in standard sized bags of the vendor, showing the weight, analysis, and vendor's name.

G. If the Contractor feels a different seed mixture will perform better within the zone specified, he may submit on such a mix.

## PART 3 - EXECUTION

### 3.1 INSPECTION

A. Check that preceding work affecting ground surface is complete.

B. Verify that soil is unfrozen and within acceptable range of moisture content.

C. Do not start until conditions are satisfactory.

### 3.2 PLANTING SOIL PREPARATION

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
2. Till surface soil to a depth of at least 6 inches. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.

3. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
4. Remove water material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

C. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture lightly. Roll and rake to provide a firm surface, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches in any dimension, and other objects that may interfere with planting or maintenance operations. Do not compact soils within athletic fields. (Compaction within athletic field areas should be at a minimum 80% and maximum 85%) The soil should be lightly rolled with a one (1) ton maximum non-vibratory roller. Roll the subgrade at a 45° horizontal angle to the proposed direction of sod placement, followed by a 2nd pass rolled at 90° to the first pass.

## 3.3 APPLICATION

A. Apply seed at the rate of six pounds per 1000 square feet.

B. Hydroseeding:

1. Mechanically agitate the required materials to form a homogeneous slurry. Spray the slurry on the ground by a hydraulic seeder equipped to apply up to 200 gallons per minute at 100 pounds pressure from the nozzle with a clearance for 1/2 inch solids.
2. When hydraulically sprayed on the ground, the material shall form a blotter-like cover impregnated uniformly with grass seed. The cover will allow the absorption of moisture and allow rainfall or added water to percolate to the underlying soil.
3. The suggestions of the manufacturer of the individual materials shall be followed in preparing and applying this hydroseeding mixture.
   However, the following minimum ingredient amounts shall be used and thoroughly and consecutively mixed together.
   Water as per manufacturer's instructions.
   Seed as specified.
   Biodegradable Binder as per manufacturer's directions.
   Fiber Mulch 27.5 lbs./1000 square feet.
4. Only use biodegradable binder on slopes greater than 4 horizontal on 1 vertical.
5. All containers and tanks used for holding and mixing the ingredients and the final homogeneous hydroseeding mixture shall have been thoroughly cleaned of all material incompatible with seed germination and which is not readily biodegradable.

C. Broadcast Seeding:

1. Uniformly broadcast seed on prepared seed bed and immediately rake into top one half inch of topsoil. Do not displace seed during raking.

2. Immediately following seeding and raking, roll seed bed with a 200 pound roller and thoroughly water with a fine spray.
3. Immediately following rolling and watering, apply straw mulch uniformly to seed bed at rate of three tons per acre.
4. Uniformly apply binder to all mulch (slopes steeper than 4 horizontal on 1 vertical) at the following rates:

   a. Chemical Binder: At manufacturer's recommended rate, or
   b. Asphalt Emulsion: 300 gallons per acre.

D. Mechanical Seeding:

1. Uniformly apply seed to prepared seed bed to a depth of one half inch by a mechanical seeder such as a Brillon or approved equivalent.
2. Immediately following seeding, roll seed bed with a 200 pound roller and thoroughly water with a fine spray.
3. Immediately following rolling and watering, apply straw mulch uniformly to seed bed at the rate of three tons per acre.
4. Uniformly apply binder to all (mulch) slopes steeper than 4 horizontal on 1 vertical.

## 3.4 RECONDITIONING LAWNS

A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regrading is required.

B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

C. Where substantial lawn remains, mow, detach, core aerate, and rake. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of it off the Owner's property.

E. Till stripped, bare, and compacted areas thoroughly to a depth of 6 inches.

F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Provide new planting soil as required to fill low spots and meet new finish grades.

G. Apply seed and protect with straw mulch as required for new lawns.

H. Apply sod as required for new lawns.

I. Water newly planted areas and keep moist until new grass is established.

## 3.5 PROTECTION

A. Immediately after seeding, protect seeded areas from all traffic until lawn is established.

B. The Contractor shall be responsible for correction of all damage done by unauthorized traffic at no additional cost.

## 3.6 LAWN ESTABLISHMENT

A. Watering:

1. Keep seed bed moist until germination of seed by application of fine spray.
2. Continue fine spraying after germination at four to seven day intervals as required to supplement natural rainfall so that all lawn areas received sufficient water for normal plant growth.
3. Furnish all equipment necessary for artificial watering and be responsible for securing an adequate supply of water.
4. The Contractor is completely responsible for all watering requirements until the lawn has been deemed satisfactory.

B. Mowing:

1. Mow lawn to a height of 2 inches when the overall height reaches 3 to 4 inches.
2. Remove clippings when height of lawn is 6 inches or higher before mowing.
3. Complete a minimum of three mowings in one growing season.

C. Fertilize:

1. After the second mowing, uniformly spread fertilizer at the rate of 5 pounds per thousand square feet.
2. Thoroughly water lawn after applying fertilizer to facilitate penetration of fertilizer particles to the soil.
3. The Contractor shall also be responsible for providing and applying fertilizer for the duration of one (1) complete growing season. Required application shall be as follows:

| Construction Time | Fertilization Required |
|---|---|
| Spring | Starter fertilizer<br>Spring turf builder with weed control<br>Fall turf builder<br>Winterizer application |
| Summer | Starter fertilizer<br>Turf builder with Summerguard protection<br>Fall turf builder |

| | |
|---|---|
| | Winterizer application<br>Following Spring turf builder and weed control |
| Fall | Starter fertilizer<br>Fall turf builder<br>Winterizer application<br>Following Spring turf builder and weed control |

All fertilizers must be approved by the Landscape Architect prior to application.

D. Erosion Repair:

1. Repair all erosion damage by filling with topsoil, compacting, fertilizing, liming, seeding, and mulching according to original Contract requirements. This shall be required until such a time that the lawn has established itself and has been approved by the Landscape Architect.

E. Mulch Removal:

1. Remove and/or replace mulch that has been displaced.
2. Keep all paved surfaces and storm sewers free of mulch material.

F. Reseeding:

1. Reseed all areas which are sparse and/or spotty and where surface soils are highly visible not having a uniform stand of grass after the first mowing.
2. If a dense lawn is not established after three mowings in the first germination period, return in the following planting season to scarify, re-fertilize, topdress, re-seed, and re-mulch to establish a uniform stand of grass after three mowings in that following season. Dense lawn can be defined as areas where surface soils cannot be seen through the grass.

3.7 CLEANUP

A. Remove trash and excess materials from project site.

B. Maintain paved areas in a clean condition.

C. Remove barriers and signs from project site at termination of establishment period.

3.8 PERFORMANCE

A. Lawn will not be considered for payment and acceptance until a satisfactory stand of grass, as judged by the Landscape Architect, and is evident after three consecutive mowings and refertilization.

B. The Landscape Architect will inspect the established lawn upon written request to the Owner by the Contractor.

C. The Contractor shall provide to the School a Schedule of Procedure including, but not limited to, fertilizing, irrigation and aeration, for the care and maintenance of the lawns in the future, prior to acceptance of the work.

D. Upon acceptance of the Work specified in this Section, the Contractor shall be relieved of further responsibility for care and maintenance of lawn.

END OF SECTION 32 92 00

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# SECTION 32 93 00

# PLANTS

## PART 1 – GENERAL

### 1.1 RELATED WORK SPECIFIED ELSEWHERE

Section 32 91 13: Soil Preparation and Mixes

### 1.2 REFERENCES

A. Plant Nomenclature: Conform to the latest edition of "Standardized Plant Names" as adopted by the American Joint Committee of Horticultural Nomenclature.

B. Size and Grading Standards: Conform to the current edition of "American Standard for Nursery Stock" - Sponsor - the American Association of Nurserymen Inc., unless otherwise specified.

### 1.3 SUBMITTALS

A. List of Plants: Before plant material is shipped to the project site, submit a complete itemized list of all plants including the source of supply.

B. Product Data: Furnish the following with each planting material delivery.

1. Invoice indicating sizes and variety of plant material.
2. Certificates of inspection required by State and Federal agencies.
3. Labels for each plant or bundles of plants indicating name and size.

C. Quality Control Submittals:

1. Worker's Qualifications Data: Names and addresses of 5 similar projects that each person has worked on during the past 2 years.

### 1.4 QUALITY ASSURANCE

A. Worker's Qualifications: The persons performing the planting and their supervisor shall be personally experienced in the planting and caring of plant material and shall have been regularly employed by a company engaged in the planting and caring of plant material for a minimum of 2 years.

B. Caliper trees up to 4 inches in caliber at a point 6 inches above ground and trees over 4 inches in caliber 12 inches above ground.

C. Do not use woody plant material from regions south of latitude 39 degrees unless such material has been lined out in nurseries located north of latitude 39 degrees for at least 2 growing seasons. Latitude 39 degrees is approximately a line from Annapolis, MD to Cincinnati, OH.

1.5 DELIVERY, STORAGE AND HANDLING

A. Notify the Owner' Representative & Engineer 48 hours in advance of delivery of plant material.

B. Protect plants against climatic and mechanical injuries.

C. Deliver fertilizer in manufacturer's standard sized bags showing weight, analysis, and manufacturer's name. Store under a waterproof cover or in a dry place as designated by the Owner's Representative.

1.6 PROJECT CONDITIONS

A. Water will be furnished by the State from existing facilities as directed. Furnish hoses and connections required to adequately water plants.

1.7 SCHEDULING

A. Plant deciduous, woody plants between October 1 and May 15 whenever temperature is above 32 degrees F and soil is in workable condition, unless otherwise approved in writing.

B. Plant evergreens between August 15 and September 15 or during April or May before start of new growth.

1.8 PLANTING GUARANTEE

A. The guarantee shall extend for a period of one year from the date of physical completion. Physical completion for the Work of this Section is the date or dates when all the planting operations, or seasonal portions of the planting operations, or replacement planting operations have been completed and are accepted by the Owner's Representative.

PART 2 – PRODUCTS

2.1 PLANTS

A. Shrubs and Trees:

1. Nursery grown stock unless otherwise indicated in the itemized plant list.
2. Acclimated plants true to genus and species.
3. Well developed root and branch systems. Do not prune branches before delivery.
4. Free of disease, insect eggs, bark abrasions, and disfiguring knots.
5. Buds intact and reasonably closed at time of planting.
6. Balled and burlapped from soil which will hold a natural ball. Manufactured balls are unacceptable.
7. Conform to size indicated or larger, or within the minimum maximum size when so indicated. Larger plants cut back to specified dimensions will not be accepted.

B. Trees:

1. Single erect leader from ground to top, surrounded with uniformly arranged branches.
2. Free from frost cracks, broken bark, and dead or broken branches.
3. Transplanted, or root pruned 360 degrees at least once during the previous 3 years.

2.2 PLANTING SOIL

A. Topsoil for Planting Soil: Use approved topsoil stripped and stockpiled on the Site.

B. Soil Amendments (For every 4 cu yd of topsoil):

1. Peat Moss: 7-1/2 cu ft bale or 15 bushels (loose measure).
2. Fertilizer: 5 lb.
3. Bonemeal: 80 lb.

C. In the presence of the Owner's Representative, place the soil amendments over the topsoil piles and turn over the combined elements a minimum of 3 times until thoroughly mixed.

2.3 FERTILIZER

A. Bonemeal: Commercial, steamed finely ground material containing not less than 1.0 percent nitrogen and 11 percent phosphoric acid.

B. Commercial Fertilizer (10-6-4): Containing not less than 10 percent nitrogen, 6 percent available phosphoric acid and 4 percent water soluble potash.

## 2.4 MULCH

A. Peat Moss: Finely granulated material, passing a 1/2 inch sieve, free of sticks, woody roots, stones and other objectionable material, and of such physical condition that it can be readily incorporated with the topsoil. Furnish material conforming to the following criteria:

1. pH value: 3.0 to 5.0.
2. Moisture: Not less than 25 percent nor more than 50 percent.
3. Organic Material: Not less than 47 percent (90 percent dry basis).

B. Shredded Wood: Wood fiber produced from either hardwood or softwood trees, free of tannic acid, leaves, young green growth, wood shavings, sawdust or other objectionable foreign material.

## 2.5 MISCELLANEOUS MATERIALS

A. Stakes, Deadmen and Guy Stakes: Sound, durable White or Red Cedar, or other approved wood, free of insect or fungus infestation.

B. Guy Wire or Cable: No. 12 galvanized iron wire or cable.

C. Tree Wrapping: 4 inch wide strips of jute burlap or waterproof paper 30-30-30 Krinklecraft by Eaton Brothers Corp., P.O. Box 60, Hamburg, NY 14075, (800) 433-3244.

D. Protective Hose: 2-ply garden hose cut to required lengths to protect tree trunk's from damage by wires.

E. Tree Wound Paint: Antiseptic, waterproof, adhesive, elastic tree wound paint containing no kerosene, coal tar, creosote, or other material harmful to cambium or living tissue.

F. Anti-desiccants: Wilt-Pruf by Wilt-Pruf Products, Inc., P.O. Box 469, Essex, CT 06426, (203) 767-7033.

PART 3 – EXECUTION

3.1 INSPECTION

A. Plants to be approved at the nursery by Owner's Representative prior to being shipped to the site.

B. Do not plant any plant material until after inspection and approval in writing of plant shipments. Secure written approval of any substitutions before planting. Remove rejected material from planting areas.

3.2 PREPARATION

A. Planting Layout:

1. Stake out tree locations and planting areas.
2. Obtain layout approval from the Owner's Representative prior to excavations of plant pits and beds.

B. Plant Pit Dimensions: Minimum width 12 inches, measured at the ground surface.

1. Balled and Burlapped Plants:

a. Pit Depth: Not to exceed the ball depth.
b. Pit Width: Measured at the ground surface, 3 times the width of the ball or as indicated.

2. Container Grown Plants: 2 times the diameter of the container measured at the ground surface.
3. Ground Cover Beds: Excavate entire bed to a depth of 4 inches.

C. Excavation: Excavate pits to the dimensions specified. Dispose of excavated material of the site unless otherwise directed.

3.03 PLANTING

A. Setting Plants:

1. Backfill pits with planting soil and firm to the level upon which plants were previously growing. Set plants plumb. Plant budded or grafted plants 2 inches below bud or graft line. Complete backfilling with planting soil and settle continually with water.

2. Balled Plants: Set plants in position and backfill 1/3 depth of ball. Remove burlap from top and adjust to eliminate air pockets. Complete backfill and settle with water.
3. Bare-root Plants: Set plant in position and place planting soil around roots settling with water. Use care to avoid bruising or breaking roots when firming soil. Prune bruised or broken roots.

B. Anti-Desiccant: Apply anti-desiccant spray to broadleaved ericaceous plants planted in the Fall season, as directed.

C. Surface Finish: Form saucer as indicated on Drawings or as directed. Grade soil to form a basin on lower side of slope plantings, which will catch and retain water. Top dress basins with fertilizer spread evenly at the rate of 1-1/2 pounds per square yard of plant pit surface. Break saucers and basins before ground freezes.

G. Mulching:

1. Spread mulch over finished surface of each plant, plant bed and hedge trench in the following amounts:

   a. Shredded Wood: 2 inches.

2. Water plants thoroughly after mulching.

H. Pruning: Prune immediately after planting using sharp tools approved by the Director's Representative. Remove approximately 1/3 of the wood of deciduous plants, maintaining the natural habit of the plant. Cut no leaders. Paint pruning cuts 3 inches in diameter or over with tree wound paint.

I. Guying: Guy deciduous trees 4 inches and over in caliber; trees over 6 feet high with 3 or more stems; and evergreens 6 feet or over in height, with 3 guys immediately after planting. Attach guys to stakes and trees as indicated. Connect multi-stem trees with protected connecting wires maintaining each stems relationship to one another.

J. Establishment of Planting: Maintain plantings immediately following planting operations and continue throughout the guarantee period. Establishment of plantings shall consist of keeping plants in healthy, growing conditions by watering, weeding, cultivating, pruning, spraying, tightening of guys, remulching and by any other necessary operations of establishment. Water all plants at least once a week between April 1 and October 31 with approximately 5 gallons per square yard (1 inch layer of water) per watering unless otherwise directed. Provide additional

watering during periods of dry weather when required or when directed. Treat plants with good horticultural preventative or remedial measures to control insects, diseases or rodents.

3.04 INSPECTIONS AND REPLACEMENTS

A. The following inspections apply only to this Section:

1. Physical Completion Inspection and Replacements: Notify the Owner's Representative in writing at least ten days prior to requested date of physical completion inspection. Remove and replace dead, unhealthy or badly impaired plants according to the original specification, if so directed. Replace plants during the next planting season if this inspection is not within a planting season.
2. End of Guarantee Inspection and Replacements: Remove stakes, guy wires and tree wrapping at the end of the one year guarantee period unless otherwise directed. Remove and replace dead, unhealthy or impaired plants according to original specification, as directed. Replace plantings during the next planting season if end of guarantee period is not within a planting season.

END OF SECTION 32 93 00

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# SECTION 33 11 16

# WATER SYSTEM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 WORK INCLUDED

A. Under this Section, the Contractor shall furnish all material, labor, tools and equipment required to provide all pipe, fittings, valves, hydrants, retainer glands and tie rods for the water lines and hydrants, as shown on the drawings, as herein specified, or as directed. The Contractor shall also be responsible for all permitting and coordination with the governing water department.

## PART 2 - PRODUCTS

### 2.1 DUCTILE IRON PIPE

A. Ductile iron pipe shall be centrifugally cast in metal or sandline molds in accordance with ANSI Specification A21.51-1981 (latest revision), in 18 or 20 foot nominal lengths. The joint shall be of the push-on type which employs a single, elongated, grooved rubber gasket to affect the joint seal and/or the standard mechanical joint and accessories, ANSI Specification A21.11 with plain rubber gasket and/or the boltless flexible joint utilizing a machined ball end, rubber gasket, separately cast bell and high strength corrosion resistant, alloyed steel retainer ring, having an allowable deflection of 15 degrees.

B. Ductile iron pipe shall have a rated working water pressure of not less than 350 psi, shall be thickness Class 52.

C. Cement Mortar Lining: Ductile iron pipe shall be cement lined (twice standard thickness) and shall be paint seal coated, in conformance with ANSI Specification A21.4-1980 (latest revision).

D. Ductile iron pipe shall be polywrapped with 8 mil minimum polyethylene in compliance with AWWA C105 and the Latham Water District Town of Colonie Standard Specifications for Water Distribution Systems adopted June 1993 and revised February 1996.

E. Ductile Iron Pipe installed inside the building shall be flanged with threaded flange or flange adapters complying with ANSI/AWWA C151/AS21.51.

## 2.2 DUCTILE IRON FITTINGS

A. Ductile iron fittings (3" through 16") shall be compact, mechanical joint fittings in accordance with ANSI/AWWA C153/A21.53 (latest revision). Mechanical Joint shall be in accordance with ANSI/AWWA C111/A21.11 (latest revision) with plain rubber gaskets, ductile iron gland and low alloy steel bolts and nuts. Ductile iron fittings shall be Class 350 for sizes 3" through 24". All ductile iron fittings shall be cement lined as specified. All ductile iron fittings shall be as manufactured by U.S. Pipe and Foundry Company, McWane Inc., or Sigma Corporation.

B. Tee bolts and nuts shall be manufactured form cor-ten steel and coated with a fluorocarbon SC-1 coating as manufactured by Stanco Industries or equal.

## 2.3 RETAINER CLAMPS AND TIE RODS

A. Retainer clamps for pipe 6 inches and larger shall be Star Figure 11 Retainer Clamps, as manufactured by Star National Products, Columbus, Ohio or approved equivalent. Tie rods for pipe 6 inches to 12 inches in size shall be Star Figure 12 all threaded rods, 5/8" or 3/4" in size with rod couplings or approved equivalent, and of such length and size as may be required for any particular location. The Contractor shall submit details of the clamps and tie rods that he proposes to use for approval of the Engineer and approval shall be obtained before purchasing. All material shall be galvanized. Retainer clamps and tie rods for pipe larger than 12 inches shall be similar to the above specifications and the Contractor shall submit shop drawings for the approval of the Engineer.

B. When tie rods are used at fittings they shall be encased in polyethylene and tar coated with Bitumastic 50 by Koppers or equal. Tie rods are not to be used without the approval of the Engineer.

## 2.4 PUSH-ON JOINT RESTRAINTS

A. In lieu of mechanical joints. With the approval of the Engineer, Field-Lok gaskets may be used for thrust restraint on pipe.

## 2.5 RETAINER GLANDS

A. Retainer glands shall be mechanical joint restraint with multiple wedging action having a working pressure of at least 250 psi and shall be as manufactured by EBAA Iron, Inc., Megalug, or approved equivalent, shall be used where applicable, as noted on the Contract Plans and/or as may be ordered by the Engineer.

## 2.6 RESILIENT WEDGE VALVES

A. Clow (F6100) or equivalent, as follows:

1. Conformance with AWWA C509-94 (or latest revision).
2. Cast iron wedge fully encapsulated in synthetic rubber.
3. Wedge rubber molded in place and bonded to the cast iron.
4. Stem shall be sealed with two O-rings, both replaceable when the valve is wide open and subjected to full rated pressure.
5. Waterway shall be smooth and shall have no depressions or cavities in seat area.
6. Epoxy coated valve body and bonnet, inside and out.
7. Open LEFT, with 2” operating nut on underground pipe, handwheel inside building.
8. Mechanical joint end connections (underground), Flanged inside the building.
9. All bolts incorporated into the valve body and bonnet shall be ASTM A320 Grade B8 stainless steel.

2.7 VALVE BOXES

A. Cast iron two-piece slide type valve box, as manufactured by Tyler Pipe (Series 6855, Item 664-A), Sigma (Item VB466), or Central Foundry Company (No. 5664-S), or equivalent.

B. Cover must be standard drop 5-1/4" lid, as manufactured by Tyler Pipe, Sigma, Central Foundry Company, or equivalent, and be clearly marked "Water".

2.8 VALVE BOX EXTENSIONS

A. All valve box extensions shall be the bottom section of a cast iron two-piece valve box, as manufactured by Tyler Pipe (Series 6855), Sigma (Item VB466), Central Foundry Company (No. 5664-S), or equivalent.

2.9 COPPER PIPE: Type K "soft" copper tubing conforming to the requirements of AWWA C800.

2.10 CORPORATION STOPS: Mueller Style H-15008, diameter per plans, or equivalent.

2.11 CURB STOPS: Shall be standard water works ground key Type T-handle, without drain, with coupling for copper tubing on the inlet and outlet. B25-209 by Mueller or McDonald 6100T or equivalent and shall be installed flush with final grade.

2.12 CURB BOXES: Style H-10314 by Mueller or McDonald equivalent for 5 feet to 6 feet burial or equivalent.

2.13 TAPPING VALVES AND SLEEVES: 304 Stainless Steel body and bolts with appropriate gaskets, and mechanical joint outlet. Mueller HYMAX H-304 or equal. Size per plan.

2.14 HYDRANTS:

A. Fire hydrants shall be Clow Valve Company manufactured Eddy Model F-2640, Mueller Super Centurion 20, or equivalent. Hydrant shall be of the break flange type with a valve opening of not less than 5 inches. Hydrants shall be installed with retainer glands and shall open left. Fire hydrant shall be supported on a solid 6-inch thick concrete block 12 inches by 12 inches square. A 6-inch resilient wedge valve shall be installed between the main and the fire hydrant. Hydrants shall be painted red. Hydrants shall meet AWWA C-502 with working pressure of 250 psi. Vertical height as required.

B. All hydrants shall receive a finish coat of paint above the ground line after installation. Paint shall be weather resistant enamel by Sherwin Williams (Sherwin Williams Industrial Enamel – Pure White) or approved equal. Hydrants shall be painted red (Sherwin Williams Kern Lustral Enamel – Vermillion) with white top and nozzle caps. All hydrants shall be furnished completely shop primed or painted in the same color and pattern as that required above. Shop primer or paint shall be chosen so as to be compatible with the type of finish paint specified above.

2.15 FLANGE ADAPTERS: EBBA Iron Series 1000 E-Z Flange for Ductile Iron Pipe, or approved equal.

A. Ductile Iron construction ASTM A536.
B. Meets ANSI/AWWA C110/A21.10.
C. SBR gaskets per ASTM A536 8065-45-12.
D. Set screws shall have Rockwell Hardness of C40-45 converted from Brinnell.
E. MEGA-BOND coating.

2.16 AIR RELEASE VALVE: APCO No. 65, ¾” inlet pipe thread, pipe discharge to floor drain with ½” PVC pipe.

2.17 LINK SEAL: Ductile Iron Pipe entering and leaving the building shall be sealed with LINK SEAL modular seal sized for the pipe. Furnish with 316 stainless hardware and WS wall sleeve cast into the wall.

## PART 3 - EXECUTION

3.1 Install all water mains, fittings, and valves in accordance with ANSI Specification C600-82 (latest revision) for installation of ductile iron water mains, fittings, and appurtenances.

A. Alignment and Grade: As shown on the Plans. Five (5) feet minimum depth to centerline of pipe unless otherwise approved.

B. Wherever obstructions not shown on the Plans are encountered during the progress of

the work and interfere to such an extent that an alteration in the Plan is required, the Engineer shall have the authority to change the Plans and order a deviation from the line and grade or arrange with the Owners of the structures for the removal, relocation or reconstruction of the obstructions.

3.2 CONNECT TO EXISTING WATER MAIN

Installation shall be performed by the use of modern equipment, designed especially for this purpose and under the direction of a skilled operator. This sleeve shall accurately fit the existing pipeline. The Contractor must determine the outside diameter and material of the existing pipeline. The Contractor shall be responsible for all coordination and permitting with regulatory authorities.

3.3 INSTALLATION OF WATER LINES IN RELATIONSHIP TO SANITARY SEWERS

The following paragraphs are from the 2012 Recommended Standards for Water Works and are applicable to work under this contract with respect to maintaining adequate horizontal and vertical separations between water lines and sewers:

A. Parallel Installation: Water mains shall be laid at least 10 feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer.

B. Crossings: Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer with preference to the water main located above the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

C. Force Mains: There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossings as required in Section 8.8.3.

D. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole. Water main should be located at least 10 feet from sewer manholes.

3.4 TRENCH: No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

3.5 LAYING PIPE: All lumps, blisters and excess coat-tar coating shall be removed from the bell-and-spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

The pipe and fittings shall be inspected for defects and, while suspended above grade, be rung with a light hammer to detect cracks.

Pipe shall be polywrapped in accordance with compliance with AWWA C105.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to insure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.

Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Engineer.

At time when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. If water is in the trench, the plug shall remain in place until the trench is pumped completely dry.

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

When machine cutting is not available for cutting pipe 20 inches in diameter or larger, the electric-arc cutting method will be permitted using a carbon or steel rod. Only qualified and experienced workmen shall be used on this work.

The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed.

3.6 PIPE JOINTS: The types of joints to be used, subject to the approval of the Engineer, shall generally be the rubber ring push-on type or mechanical type joint. All joints, regardless of type, shall be installed in strict accordance with the pipe manufacturer's published instructions and procedures.

3.7 PIPE ANCHORAGE: All plugs, caps, tees and bends shall be provided with a reaction backing, or movement shall be prevented by attaching suitable metal rods or clamps as shown or specified.

Reaction backing shall be concrete of a mix not leaner than 1 cement; 2½ sand; 5 stone; and having a compressive strength of not less than 2,000 psi at 28 days. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown or directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair. Where mechanical thrust restraints are placed, solid blocks may be installed from the fitting back to bear against undisturbed soils.

Metal harness of tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing, as directed by the Engineer. Steel rods or clamps shall be galvanized or otherwise rustproof treated, or shall be painted as shown or directed by the Engineer.

3.8 FLUSHING: Flush new water lines thoroughly at line pressure. Do not allow water to travel through undisinfected lines back into the system. Suitable arrangements shall be made so as not to cause flooding problems when flushing.

3.9 HYDROSTATIC TESTING

A. Hydrostatically test all pipe in accordance with the following conditions:

1. Pressure - 1½ times the working pressure, minimum of 150 psi.
2. Test pressure ±5 psi during test.
3. Duration - Two hours.

B. Pressurization: Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connection to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor. The Contractor shall furnish all necessary assistance for conducting the tests.

C. Removal: Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blow-offs are not available at high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert the plugs after the test has been completed.

D. Examination: All exposed pipes, fittings, valves, hydrants and joints will be carefully examined during the open trench test. When the joints are made with lead, all such joints showing visible leaks shall be recaulked until tight. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material in the manner provided under Part 3, and the test shall be repeated until satisfactory to the Engineer.

E. Leakage Test: A leakage test shall be conducted after the pressure test has been satisfactorily completed. The Contractor shall furnish the pump, pipe, connections and all other necessary apparatus, and shall furnish all necessary assistance to conduct the test. The duration of each leakage test shall be two hours, and during the test the main shall be subjected to not less than the maximum working pressure.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

in which L equals the allowable leakage, in gallons per hour; S is the length of pipe line tested, in feet; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

F. Variation from Permissible Leakage: Should any test of pipe laid disclose leakage greater than that specified, the Contractor shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

G. Time for Making Test: Pipe may be subjected to hydrostatic pressure and inspected and tested for leakage at any convenient time after the trench has been partially backfilled. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high, early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

H. Pressure and Leakage Tests After Backfilling: After the trench has been backfilled, the test connections made and the main filled with water, the test sections shall be subjected to water pressure normal to the area. After examination of exposed parts of the system, the test pressure will be increased to the hydrostatic pressure specified and exposed parts again examined.

If defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The Engineer will then repeat the pressure test until no defects are found.

The duration of the final pressure test shall be at least two hours.

The leakage test shall be conducted after satisfactory completion of the pressure test, in accordance with Section 3.11.5. Should any test section fail to meet the leakage test, the Contractor shall make the necessary repairs at his own expense.

3.10 DISINFECTION: Upon completion of the work and before final acceptance, the water lines

construction under this contract shall be chlorinated. Prior to chlorination, all dirt and foreign matter shall be removed by a thorough flushing through the hydrants, or by other approved means. Each valved section shall be flushed independently.

3.11 The method of disinfection shall consist of introducing a solution of hypochlorite or chlorine gas and water in controlled quantities into the piping system in such proportion that the chlorine water mixture entering the piping shall contain sufficient chlorine solution so that there shall be a chlorine residual throughout the entire system of not less than 50 ppm. If the residual at any point in the system is less than 25 ppm after the 24-hour period, the disinfection procedure shall be repeated until such a residual is obtained at the pipe extremities.

Other methods of disinfection than that stated above will not be allowed unless approved by the Engineer. To request approval of an alternate method, submit in detail a written description of the proposed method for review by the Engineer. The alternate method will also have to be approved by the local Health Department following the Engineer's review.

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe lines (also see 3.14) at their extremities until the replacement water throughout its length shall, upon testing both chemically and bacteriologically, be satisfactory to the Engineer. Should the initial treatment, in the opinion of the Engineer, prove ineffective, the chlorination procedure shall be repeated until conformed tests show that the water samples from the newly laid pipe conform to the requirements of the Engineer.

Any section of main, including capping of mains, that cannot be disinfected as specified above shall be disinfected by swabbing the interior of pipe and fittings with a 5% hypochlorite solution immediately before construction:

A. Dissolve one ounce 70% calcium hypochlorite (HTH or perchloron) as a paste in each 26 gallons of clean water, or

B. Add 4 fluid ounces of 5% liquid bleach to each 8 gallons of clean water, or

C. Add 4 fluid ounces of 14% liquid bleach to each 24 gallons of clean water.

Each of these solutions has about a 200 mg/l concentration of available chlorine.

3.12 Chlorinated water discharged from the main(s) shall not be discharged to surface waters unless the chlorine residual is less than 0.1 PPM. Chlorinated water shall be treated by the Contractor to neutralize the chlorine solution to meet the above noted residual.

Chlorinated water discharged from the main(s) and onto the ground shall be done in such a manner so as not to damage lawns, other surfaces, and property.

3.13 BACTERIOLOGICAL TESTS OF WATER MAIN

A. Standard Conditions: After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected form the new main. (NOTE: The pipe, the water loaded into the pipe, and any debris exert a chlorine demand that can interfere with disinfection.) At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. Samples shall be tested for bacteriological (chemical and physical) quality in accordance with *Standard Methods for the Examination of Water and Wastewater*, and shall show the absence of coliform organisms and, if required, the presence of a chlorine residual. A standard heterotrophic plate count (HPC) test is required because new material does not typically contain coliforms but does typically contain HPC bacteria.

B. Sampling Procedure: Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulphate, as required by *Standard Methods for the Examination of Water and Wastewater*. No hose or fire hydrant shall be used in the collection of samples. (NOTE: For pipe repairs, if no other sampling port is available, well flushed fire hydrants may be used with the understanding that they do not represent optimum sampling conditions.) A suggested combination blowoff and sampling tap used for mains up to and including 8-inch diameter is shown in Figure 2 of the Standard. There should be no water in the trench up to the connection for sampling. The sampling pipe must be dedicated and clean and disinfected and flushed prior to sampling. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

C. Sample Results: If sample results from a lab, approved by the New York State Health Department, indicate any coliform organism or measured HPC greater than 500 colony-forming units (cfu) per mL, flushing should be resumed and another coliform and HPC set of samples should be taken until no coliforms are present and the HPS is less than 500 cfu/mL.

D. Record of Compliance: The record of compliance shall be the bacteriological test results certifying that the water sampled from the new water main is free of coliform bacteria contamination and is equal to or better than the bacteriologic water quality in the distribution system.

E. Re-disinfection: If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, the new main may be re-flushed and shall be re-sampled. If check samples also fail to produce acceptable results, the main shall be re-chlorinated by the continuous feed or slug method until satisfactory results are obtained - that being two consecutive sets of acceptable samples taken 24 hours apart.

NOTE: High velocities in the existing system, resulting from flushing the new main,

may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main to determine the source of turbidity.

3.14 Install retainer glands in accordance with the manufacturer's instructions in the locations shown on the Plans or as directed by the Engineer.

3.15 Install all valves, valve boxes, and hydrants in a plumb position. Valve boxes shall be set flush to finished grade on well tamped backfill to avoid settlement.

3.16 Install valves in strict accordance with applicable AWWA specifications for mechanical joint resilient wedge valves.

3.17 Installation of the tapping valve and sleeve shall be performed by the use of modern equipment, designed especially for this purpose and under the direction of a skilled operator. The sleeve shall accurately fit the existing pipeline. The Contractor must determine the outside diameter and material of the existing pipeline.

3.18 Install mechanical joint retainer glands on the hydrant lateral connecting pieces.

3.19 When hydrants are installed and not in service, they shall be covered with bags to indicate that they are out of service. The Contractor shall notify the local firehouse when hydrants are out of service.

3.20 All hydrants shall be furnished completely shop primed and painted red when delivered from the manufacturer. The Contractor shall completely repaint the hydrant with the same type of paint as the original shop painting. The Contractor shall repaint the hydrant red with white top and nozzle caps.

3.21 All overhead ductile iron pipe shall be supported vertically in accordance with AWWA standards, at a spacing not less than more than 10 feet. Support horizontally with structural support to building structural member.

3.22 All exposed ductile iron pipe to be painted with approved primer and top coat, in accordance with the painting specification. Color by Architect.

END OF SECTION 33 11 16

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# SECTION 33 31 00

# SANITARY SEWAGE DISPOSAL SYSTEM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of 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. Construction of sanitary sewage collection system.
2. Construction of force main and pump station and controls.
3. Electrical wiring and connections to all sanitary sewage system electrical components.

B. Related Sections include the following:

1. Section 02 30 00: Soil Testing Services.
2. Section 31 23 00: Earthwork.
3. Section 31 23 16: Trenching, Backfilling and Compaction.

### 1.3 SUBMITTALS

A. Contractor shall submit for review manufacturer's literature on all structures, piping, equipment, and controls for the complete system. An additional 2 copies of the following shop drawings shall be submitted for regulatory submission requirements:

1. Complete effluent pumping system including, but not limited to, all valves, floats, junction boxes, pump rail assemblies, pumps
2. Control panel
3. Manual transfer switch
4. Pump motor disconnects
5. Pipe supports

### 1.4 REGULATORY COMPLIANCE

A. The contractor shall coordinate all inspections with the Engineer, the Architect, and the Westchester County Health Department.

### 1.5 FUNCTIONAL DESCRIPTION

A. Underground sanitary sewage systems shall be designed for H-20 loading conditions, complete with piping and covers. Pump Stations to include all controls and wiring.

1.6 DELIVERY, STORAGE AND HANDLING

A. Exercise care to prevent damage to materials during loading, unloading and transporting. Unload and store materials and equipment in strict accordance with the manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

A. Precast, reinforced concrete manholes, as manufactured by Fort Miller Company, Inc. or an approved equivalent. Design load shall be according to AASHTO H-20. Reinforced concrete shall be 5,000 psi concrete. Air-entrained cement shall be used. Reinforcing steel shall conform to ASTM A615-A497, latest revision. Knockout units are not acceptable, unless stipulated. Units shall be provided with flexible watertight connections.

B. Frame and Cover: Shall be EJ Group, Inc., Pattern 1207/1203, or an approved equivalent.

C. Concrete: Shall be first class concrete, 5,000 psi.

D. Manhole Steps: Manhole steps shall be made of steel and coated with co-polymer polypropylene plastic, Type PS2-OF, as manufactured by M. A. Industries, Inc. or an approved equivalent. The co-polymer polypropylene used in manhole steps shall conform to A.S.T.M.D. 4101-82 PP200B33454Z02.

The steel shall be ½" reinforcing rod grade 60 and conform to all requirements of ASTM A-615. The manhole steps shall be installed at the time of the manufacture of the manhole in accordance with the manhole step manufacturer's recommendations.

E. Gaskets: Gaskets shall be E-Z Stik butyl gaskets, as manufactured by Concrete Products Supply Company, or an approved equivalent.

2.2 PVC GRAVITY SANITARY SEWER PIPE

A. Pipe and fittings shall be polyvinyl chloride, conforming to ASTM D-3034 (latest revision) for SDR 26, Type PSM with rubber gasket joints. Pipe sizes, slopes, perforation patterns (where called for) shall be as called out on the plans.

2.3 SANITARY SEWER FORCE MAINS

A. Pressure pipe: Shall be Push on PVC pipe, SDR21, Class 200 meeting ASTM

Specification D-2241 (latest revision).

B. Pipe and fittings inside pump station: PVC Schedule 80, size per plan.

C. Pipe and fittings inside valve vault: PVC Schedule 80, Solvent Welded

D. Gravity Sanitary Sewer: PVC pipe and fittings meeting ASTM D-3034, ASTM D-1784, ASTM D-2444, ASTM D-3212, and ASTM F-477 (latest revisions) for SDR 26, Type PSM with rubber gasket joints.

2.4 PVC SEWER FITTINGS

A. All fittings shall be of the same material as the pipe and shall be consistent therewith in strength, dimensions and utility.

2.5 PREFABRICATED FIBERGLASS SEWAGE PUMP STATION:

A. Heavy duty, reinforced fiberglass duplex pump station submersible effluent pumps as manufactured by Emmons Pump Company or an approved equivalent.

1. Pump station to be Duplex 48” Dia. by 96” deep fiberglass basin as manufactured by TOPP Industries Incorporated or approved equivalent with the following components:

   a. Aluminum cover with access hatch, padlockable
   b. Anti-flotation collar
   c. HOMA guide rail components
   d. Upper guide rail bracket
   e. 1” SST guide pipes
   f. SST lift chain with shackles
   g. SST piping and valves
   h. SST gate valve ext. handle
   i. Duplex mounting studs
   j. 2” NPT SST discharge coupling
   k. 2” conduit coupling
   l. 4” inlet hub, shipped loose

2. Grinder Pumps: PENTAIR Hydromatic HPG200, 2.0 hp, 208/230-3-60 electric submersible grinder pump 3450 RPM with 1-1/4” discharge, 5” impeller. 50 GPM @ 40’ TDH. Furnish with 35’ cable length. (Qty. – 2).
3. Base elbows to be 1.25” x 2” with auto-couplings as manufactured by PENTAIR Hydromatic or approved equivalent (Qty. – 2).
4. Four float level control, Pump off, lead, lag, high alarm. Alternating pump operation.
5. Float-Based Pump Control Panel: Ion Intellipump as manufactured by Metropolitan Industries, Inc. or approved equivalent with the following components:

a. NEMA 4X enclosure, padlockable
b. Motor protective switch and contactor per pump
c. Duplex mechanical alternator
d. Seal fail and hi-temp cut outs per pump
e. Mountable NEMA 4x LCD Ion Intellipump Display
f. Pump run indicators and H/O/A switches on door
g. Primary transducer control with (2) float back-up
h. Terminal blocks
i. Hi-water alarm light and horn
j. Dry alarm contact for remote

6. Pump control panel to be mounted inside the building. Furnish pump station control panel with external alarm horn and alarm light to be mounted outside the building. Include power wiring and control wiring.
7. Furnish pump station with 4” diameter above grade vent that vents underground through the building interior vent system to roof elevation.

2.6 ODOR CONTROL MANHOLE INSERT: (For new sanitary manholes)

A. ABS plastic, 3/32" minimum thickness, meeting Federal Standard LP 1183, and ASTM D 256, D 638, D 790, D 792, D 785, and D 648. Insert shall have factory installed 1" nylon lift straps and closed cell neoprene rim gasket as manufactured by Pennington Equipment Company or an approved equivalent.

1. Dioxide pellet odor control material: Chlorine dioxide pellets specifically manufactured for treatment of hydrogen sulfide, as manufactured by Pennington Equipment Company or an approved equivalent.

B. Pump Station Vent Stack Odor Control Cartridge: Sweet Filter II Schedule 40 PVC vent with dioxide pallet fill material, size per vent stack size, as Manufactured by Pennington Equipment Company or an approved equivalent.

## PART 3 - EXECUTION

3.1 TRENCHING, BACKFILLING AND COMPACTION

A. As specified and as shown on the contract drawings, except for absorption trench system.

3.2 Construct structures in accordance with the details shown on the drawings or as approved by the Engineer. Set manhole frames and covers to the required grade and on a full bed of mortar. Do not use more than 8 inches of bricks; adjust frame and cover to grade.

3.3 All joints shall be as above specified and shall be installed in complete accordance with the

requirements of the manufacturer.

3.4 If any defective pipe or jointing assembly is discovered after being installed, it shall be removed, corrected and replaced.

3.5 All pipes and jointing assemblies shall be cleaned before they are laid, and shall be kept clean until they are inspected and accepted with the completed work. Open ends of pipe shall be kept properly plugged to prevent entrance of dirt, debris and water. Unless otherwise directed, pipe shall be laid uphill, without any break in the line from manhole to manhole. When not laying pipe, the end of the line shall be kept properly closed, so as to prevent entrance of all dirt and water.

3.6 Trenches in which various pipes are to be constructed shall be excavated in open cut from the surface, unless otherwise directed in writing, and in all cases in such manner and to such depths and widths (for sewer trenches not less in width than 12 inches greater than the maximum external diameter of the barrel of the pipe), as will give suitable room for building of the structure it is to contain and for removing from the trench or other excavation any material which the Engineer may deem not proper for foundation.

3.7 In all pipe trenches, suitable materials shall be filled in around the pipe, and to a height of not less than 1 foot, and to a greater height if so directed, over the top of the pipe. This fill shall be brought up evenly on both sides of the pipe in layers of a thickness directed by the Engineer. Each layer shall be tamped and thoroughly consolidated to provide proper support and bearing for the pipe, and so as not to disturb the line and grade of the pipe. The backfill of the trench above this point over the top of the pipe shall be as specified hereafter.

3.8 Care must be taken not to move, without the consent of the Engineer, any sewers, drains, culverts, water, gas or other pipes or poles or other structures, and in crossing such pipes or structures, or in running parallel with or near them; they shall be securely hung, braced and supported in place until the work is completed. Whenever it is necessary to interfere with said structures, the contractor, at his own expense, shall maintain their respective services, and if necessary for that purpose, shall lay temporary water, gas or other pipes, or other structures. The Contractor shall repair all damage done to any of said structures through his acts or neglect, and shall keep them in repair until one year after the completion of the work. He shall leave them in as good condition as they were previous to the commencement of the work.

3.9 In case of a gas, water or other pipe becoming broken in the prosecution of the work, the Contractor shall give immediate notice to the proper authorities, and shall be responsible for any damage to persons or property caused by such breaks, and failure to give prompt notice to the authorities shall make the Contractor responsible for any needless loss of water or gas.

3.10 The trench and other excavations above pipe grade shall be carefully refilled as soon as possible after construction of the pipe line or other structure with such of the excavated materials, and in such order as may be from time to time directed. No portion of a trench or other excavation shall be backfilled until the structure contained in it has been examined and approved. When, for any reason the work is left unfinished, all trenches and other

excavations shall be filled, if so required by the Engineer, and the roadways and sidewalks left unobstructed, with their surface in a safe and satisfactory condition. In unpaved areas, the backfill above the pipe shall be carefully consolidated, in order to prevent settlement. The trench shall be tamped sufficiently to prevent any settlement of or damage to adjacent structures.

In all pipe trenches, suitable materials shall be filled in around the pipe, and to a height of not less than 1 foot, and to a greater height if so directed, over the top of the pipe. This fill shall be brought up evenly on both sides of the pipe in layers of a thickness directed by the Engineer. Each layer shall be tamped and thoroughly consolidated to provide proper support and bearing for the pipe, and so as not to disturb the line and grade of the pipe. The backfill of the trench above this point over the top of the pipe shall be as specified hereafter.

3.11 No rock or frozen earth over 10 inches in diameter shall be put in the trench until the refilling has reached at least 2 feet above the top of the pipe lines, and then not unless specifically permitted. All spaces between suitable pieces of rock shall be thoroughly filled with earth by backfilling with alternate layers of rock and earth.

3.12 When the trench is in a macadamized or paved street, the backfilling shall be done in the following manner:

After the backfill has been placed around the pipe or such other structure, to a height of 1 feet over the top, the remaining backfill shall be deposited in 6 inch layers and thoroughly tamped. The tamping shall be done by suitable mechanical means so far as possible. The machine used shall be of a type satisfactory to the Engineer and shall be used in such a manner as will thoroughly compact the backfill to a degree which will ensure against later settlement in the judgment of the Engineer. In all cases, special care shall be taken to see that the spaces at the sides of the trench or other excavations are thoroughly filled and rammed. If necessary, the earth shall be moistened during the operation.

3.13 The Contractor shall furnish, put in place and maintain such sheeting and bracing as may be required to support thoroughly the sides of the excavation (whether above or below pipe grade), and to prevent any movement which might injure the sewers, diminish the width necessary for proper drainage, or otherwise injure or delay the work or interfere seriously with adjoining structures or operations. That portion of the sheeting in the trench extending below the top of the pipes shall be withdrawn, unless otherwise directed by the Engineer, before more than 6 inches of earth is placed above the top of the pipes. As the trench is refilled, the sheeting and timbering shall be removed in such a manner as to avoid the cave-in of the trench. The vacancy left by the sheeting shall be carefully refilled by ramming, or otherwise as directed. Where cavities or pockets have developed outside of sheeting, they shall be carefully backfilled and consolidated to the satisfaction of the Engineer, even if it is necessary to make an opening from the ground surface for this purpose.

3.14 Cut ends of pipe shall be reamed/scraped clean of all loose material as a result of cutting the pipe.

3.15 Thoroughly flush all sanitary sewers, manholes, and force mains prior to testing.

## 3.16 TESTING (GRAVITY SEWERS)

A. Inspection:

1. After backfilling full depth, gravity sewer pipes shall have been so constructed that a visual inspection from manhole to manhole through the pipe shows a clear full circle with no bends, dips, rises or obstructions.

B. Correction:

1. Correct all alignment errors.
2. Reinspect to verify that alignment errors have been corrected.

C. Low Pressure Air Test (for gravity sewers): Test all sewer pipe in conformance with ASTM C-828, after thoroughly flushing sewers, and as follows:

1. Test pressures specified shall be commensurately increased for groundwater elevations above the pipe, in accordance with UNI B-6 by Uni-Bell Plastic Pipe Association.
2. Clean and wet the inside of the pipe thoroughly before testing.
3. Insert test plugs in ends of pipe to be tested.
4. Slowly fill the pipe with air to a pressure of 4 PSIG and maintain pressure between 4 and 3.5 PSIG for at least two minutes for temperature stabilization.
5. Check all plugs for tightness.
6. With a pressure of 4 PSIG ± in the pipe, disconnect the air supply.
7. Allow pressure to drop to 3.5 PSIG, then determine the elapsed time for the pressure to further drop to 2.5 PSIG.
8. The line is considered acceptable if the time for the pressure to drop from 3.5 PSIG to 2.5 PSIG is not less than the amount determined by the following table:

MINIMUM ACCEPTANCE TIMES

| Length For | Time For |
|---|---|

| Diameter (In.) | Min. Time (Min.:Sec) | Min. Time (Ft.) | Longer Length (Sec.) |
|---|---|---|---|
| 4 | 3:46 | 597 | 0.380L |
| 6 | 5:40 | 398 | 0.854L |
| 8 | 7:34 | 298 | 1.520L |
| 10 | 9.26 | 239 | 2.374L |
| 12 | 11:20 | 194 | 3.418L |
| 15 | 14:10 | 159 | 5.342L |
| 18 | 17:00 | 133 | 7.692L |
| 21 | 19:50 | 114 | 10.470L |
| 24 | 22:40 | 99 | 13.674L |
| 27 | 25:30 | 88 | 17.306L |
| 30 | 28:20 | 80 | 21.366L |

Where L is the length of sewer when it is above the "Length for Min. Time"

9. If the leakage exceeds the specified amount of the section under test, the contractor shall make the necessary repairs and retest until acceptable leakage requirements are met.

3.17 Thoroughly flush all sanitary sewers, manholes and force mains.

3.18 TESTING (Force Mains):

A. Hydrostatically test all force main piping after thoroughly flushing with the following conditions:

1. Pressure - 75 psi.
2. Test pressure ± 5 psi during test.
3. Duration - two hours.

B. Contractor shall test PVC sewer piping hydrostatically. Coordinate tests with Engineer and/or his representative. Contractor shall furnish all pumps, pipe connections, all necessary apparatus and personnel to conduct tests. Expel all air from piping prior to test. If connections or blowoffs are not already available at high points, Contractor shall make necessary connections to expel air. Properly plug connections after test.

C. Pressurization: Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connection to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor. The Contractor shall furnish all necessary assistance for conducting the tests.

D. Removal: Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blow-offs are not available at high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert the plugs after the test has been completed.

E. Examination: All exposed pipes, fittings, valves, and joints will be carefully examined during the open trench test. When the joints are made with lead, all such joints showing visible leaks shall be re-caulked until tight. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material in the manner provided under Part 3, and the test shall be repeated until satisfactory to the Engineer.

F. Leakage Test: A leakage test shall be conducted after the pressure test has been satisfactorily completed. The Contractor shall furnish the pump, pipe, connections and all other necessary apparatus, and shall furnish all necessary assistance to conduct the test. The duration of each leakage test shall be two hours, and during the test the main shall be subjected to not less than the maximum working pressure.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

$$L = \frac{SD\,(P)^{0.5}}{133{,}200}$$

in which L equals the allowable leakage, in gallons per hour; S is the length of pipe line tested, in feet; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

G. Variation from Permissible Leakage: Should any test of pipe laid disclose leakage greater than specified, the Contractor shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

H. Time for Making Test:

Pipe may be subjected to hydrostatic pressure and inspected and tested for leakage at any convenient time after the trench has been partially backfilled.

Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high, early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

I. Pressure and Leakage Tests After Backfilling: After the trench has been backfilled, the test connections made and the main filled with water, the test sections shall be subjected to water pressure normal to the area. After examination of exposed parts of

the system, the test pressure will be increased to the hydrostatic pressure specified and exposed parts again examined. If defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The Engineer will then repeat the pressure test until no defects are found.

The duration of the final pressure test shall be at least one hour.

The leakage test shall be conducted after satisfactory completion of the pressure test, in accordance with Section 3.18.3. Should any test section fail to meet the leakage test, the Contractor shall make the necessary repairs at his own expense.

3.19 CORRECTION

A. Correct all leaks and alignment errors.

B. Retest and inspect until satisfactory results are achieved.

3.20 LEAKAGE TESTING FOR SANITARY MANHOLES

A. Perform leakage test as described in Paragraph 3.18 above, with the following allowable leakage:

1. Allowable loss for each 4 ft. diameter manhole is 0.057 gallons per hour for every foot of water above the invert of the sewer.
2. Allowable loss for each 5 ft. diameter manhole is 0.071 gallons per hour for every foot of water above the invert of the sewer.

3.21 REQUIRED SYSTEM START UP

A. After completion of the construction of the wastewater disposal system, the Contractor shall assist in testing and startup of the system.

1. The Contractor shall employ and have on site a pump manufacturer's and control panel manufacturer’s representative for system startup. The representative shall be responsible for the following:

a. Test all controls including activation of alarms at control panel.
   * test low level float and alarm;
   * test pump start and stop.
b. Perform a volumetric flow test to verify flow rate from each pump.
c. Pump representative and Contractor shall coordinate float settings with Engineer to ensure proper functionality.
d. Provide a certified pump startup report signed by the construction manager's witness and the contractor. Provide a separate startup report from the manufacturer's representative certifying that the complete effluent pumping system, including control panel, meet or exceed the requirements of the contract documents and that all

required steps have been performed.

2. All tests will be witnessed by the Engineer, Contractor and a representative of the regulatory agency. Notify the Engineer, Architect and Construction Manager one week in advance of system startup.
3. The septic tank, miscellaneous concrete structures, and installed pipe joints, must be watertight. Fill septic tank at least 3" above any intermediate joint. Monitor for at least 24 hours. Fix any area of leakage.

B. Provide safe access and cooperation to the Engineer and Health Department (as required) personnel for observing work on the job site.

C. Contractor shall provide record plans of installed system. Plans shall include dimensions to buried structures without surface accessways. Contractor shall employ a registered surveyor to survey the installed system including invert elevations.

D. The Contractor shall utilize all means necessary to prevent damage to the new sewage disposal system during all phases of construction. Any damage incurred during construction shall be repaired to the satisfaction of the Engineer, at no additional cost to the owner.

END OF SECTION 33 31 00

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# SECTION 33 40 00

# STORM SEWER SYSTEMS

## PART 1 - GENERAL

1.1 Applicable provisions of the Contract, General Clauses and General Specifications govern work under this section.

1.2 WORK INCLUDED: Construction of new catch basins, inline drains, drain basins, storm sewer piping, and appurtenances. Provide temporary means of conveyance for all existing disrupted systems until new systems are operational.

1.3 The Contractor shall submit drawings for the Engineer's review of each precast catch basin, drywell, and pipe which is proposed to be furnished.

1.4 RELATED SECTIONS

Section 31 23 00: Earthwork.
Section 31 23 16: Trenching, Backfilling and Compaction.
Section 32 10 00: Roadway and Miscellaneous Surface Subbase.

## PART 2 - PRODUCTS

2.1 CATCH BASINS: Shall be precast concrete having a 28-day compressive strength of 4,000 psi, minimum 5% air entrainment, and reinforcing steel meeting ASTM A615-A497. They shall be designed for AASHTO H-20 loading, as manufactured by Fort Miller Company, or an approved equivalent. Pipe connections shall be accomplished with masonry cement (knockouts are not acceptable). (Sizes as indicated on Plans.)

2.2 PLASTIC CATCH BASINS/DRAINAGE BASINS: Inline drain/drain basin designed for AASHTO H-20 loading, with cast iron grate, as manufactured by Nyloplast America, Inc. or equivalent. Grates shall be lockable. Basin sizes per Plans.

2.3 STEPS: Where depth of catch basin is greater than 2 feet, MA Industries PS-2-PF Polypropylene or Alcoa #16027B or equivalent aluminum steps shall be provided 12 inches on center.

2.4 CATCH BASIN INSIDE DIMENSIONS: As shown on Plans.

2.5 CONCRETE BRICK: Shall meet NYSDOT Specification 704.02, Concrete Brick.

2.6 MORTAR: Shall meet NYSDOT Specification 705.21, Mortar for Concrete Masonry.

2.7 BACKFILL MATERIALS: See Section 31 23 16 - Trenching, Backfilling and Compaction, and the Contract Drawings.

2.8 GRADE ADJUSTMENT: Solid concrete brick or concrete grade rings.

2.9 FRAME AND GRATES: Compatible cast iron frames & grates designed for AASHTO H-20 loading, as shown on plans.

2.10 SMOOTH INTERIOR CORRUGATED POLYETHYLENE STORM SEWER PIPE: This specification applies to high density polyethylene (HDPE) corrugated pipe with an integrally formed smooth interior. Pipe products must be NYSDOT approved and be included on their list of approved manufacturers. Eight and 10-inch diameter pipes shall conform to the strength requirements of AASHTO M252 with the addition that the pipe have a smooth interior liner. Twelve to thirty-six-inch diameter pipe shall conform to AASHTO M294 Type S. Pipe shall be perforated in specific locations where indicated on the plans.

Pipe shall be Type HI-Q as manufactured by Hancor, Inc., Type N-12 as manufactured by Advanced Drainage Systems, Inc., or approved equivalent.

The pipe and fittings shall be free of foreign inclusions and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Corrugated fittings may be either molded or fabricated by the manufacturer.

Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer.

Joints shall be made with manufacturer’s integral-bell system, split couplings or sleeve type couplers, corrugated to match the pipe corrugations, and shall engage a minimum of 6 corrugations for 12" and 24" diameter and 4 corrugations for 30" and 36" diameter pipe. The coupler shall be fabricated by the pipe manufacturer to ensure compatibility.

2.11 PERFORATED HDPE IN SOCK: Perforated corrugated HDPE pipe with manufacturer's integral synthetic filter wrap around pipe circumference, highway sleeve type, as manufactured by Hancor, Inc., or an approved equivalent.

2.12 FLARED END SECTION: Prefabricated, galvanized steel end sections complying with NYSDOT Specification 707-10, as manufactured by Lane Enterprises, Inc.

2.13 HYDRODYNAMIC SEPARATOR: Cascade Separator Model CS-6 as manufactured by Contech Engineered Solutions or approved equivalent. See plans for pipe layout & invert information.

PART 3 - EXECUTION

3.1 Precast catch basin and inline drains shall be located as indicated on contract plans and as specified. Proposed locations shall be excavated to a depth as indicated on plans. Catch basins shall then be placed on a subbase per the plans and Section 31 23 16.

3.2 A minimum of one course of concrete brick or concrete grade ring shall be placed and mortared between the frame and top of catch basin.

3.3 The frame and grate shall be properly positioned and mortared to the top of the concrete bricks/grade rings as required.

3.4 Adjust existing catch basins to the new grade as required. Replace top sections if required or install extension sections of precast concrete compatible with the existing structure.

3.5 All joints shall be as above specified and shall be installed in complete accordance with the requirements of the manufacturer. Joints shall be watertight.

3.6 If any defective or damaged pipe or jointing assembly is discovered after being installed, it shall be removed, corrected and replaced. All expense resulting from defective or damaged pipe or jointing assemblies shall be borne by the Contractor.

3.7 All pipes and jointing assemblies shall be cleaned before they are laid, and shall be kept clean until they are inspected and accepted with the completed work. Open ends of pipe shall be kept properly plugged to prevent entrance of dirt, debris and water. Unless otherwise directed, pipe shall be laid uphill, without any break in the line from manhole to manhole. When not laying pipe, the end of the line shall be kept properly closed, so as to prevent entrance of all dirt and water.

3.8 Pipe bedding will be required for all storm sewer lines, where excavation of rock is encountered, where pieces of concrete or masonry or other debris is encountered, or where the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material or other unsuitable material.

3.9 The Contractor will establish line and grade for the construction of all storm sewers by staking the location of each manhole and/or catch basin and/or drywell providing elevations (based upon contract datum) at each drainage structure. The Contractor shall work from such points and shall be responsible for all measurements necessary to establish such supplementary lines and grades that are required in order for him to install the storm sewers on the lines and at the grades shown on the drawings, or as modified at the request of the Engineer to meet changed conditions or as a result of modifications to the work covered by the contract.

The Contractor shall furnish, at his own expense, such stakes and other required equipment, tools and materials, and all labor that may be required in laying out the work as described above.

3.10 Trenches in which various pipes are to be constructed shall be excavated in open cut from the surface, unless otherwise directed in writing, and in all cases in such manner and to such depths and widths that will give suitable room for building of the structure it is to contain and for removing from the trench or other excavation any material which the Engineer may deem not proper for foundation. For storm sewer lines, the maximum width of trench at the top of the pipe shall comply with specified limitations and details shown on the plans.

3.11 In all pipe trenches, suitable backfill materials, as called out on the plans, shall be filled in around the pipe as shown on the plans. This fill shall be brought up evenly on both sides of the pipe in 8 inch maximum layers. Each layer shall be tamped and thoroughly consolidated to provide proper support and bearing for the pipe, and so as not to disturb the line and grade of the pipe. The backfill of the trench above this point over the top of the pipe shall be as specified hereafter and/or as shown on the plans.

3.12 The length of the trench to be opened or the area of the surface to be disturbed or unrestored at any one time shall be limited with regard to expeditious construction and to the convenience and comfort of the persons residing in the neighborhood or frequenting the project area in question.

New trenching will not be permitted when earlier trenches need backfilling or labor is needed to restore the surfaces of streets or sidewalks to a safe and proper condition.

3.13 First class bedding which will provide a load factor of 1.9 will be required for the installation of sewer pipe lines. This may be accomplished by either of the following methods:

A. By so-called shaped bedding with tamped backfill. The bottom of the trench excavation shall be shaped to conform to a cylindrical surface with radius at least 2 inches greater than the radius of the outside diameter of the pipe and for a width sufficient to allow six-tenths of the width of the pipe barrel to be bedded in pipe bedding placed in the shaped excavation.

Carefully compacted backfill shall be placed at the sides of the pipe and to a depth above the top of the pipe as shown on the plans.

B. Compacted bedding with tamped material placed on a flat trench bottom. Granular material shall be as called out on plans and in Section 31 23 16, with minimum bedding depth of 4 inches or one-fourth the outside pipe diameter, whichever is greater, and shall extend half way up the pipe barrel of the sides. The remainder of the side walls and a minimum depth over the top of the pipe as shown on the plans shall be backfilled with carefully compacted selected materials.

3.14 All excavated and other materials shall be so placed as not to endanger the work, and so that free access may be had at any time to all parts of the trench and to all structures and

pipes in the vicinity, and shall be kept neatly piled, so as to inconvenience as little as possible public travel or the adjoining tenants. All fences and other structures in the vicinity of the work shall be protected and, if injured, shall be repaired or replaced. All trees in the vicinity of the work shall be protected in a satisfactory manner.

3.15 The Contractor shall provide and maintain at his expense ample means and equipment such as pumps, well point systems, drains, and sumps for dewatering and properly disposing of water entering the trenches and other parts of the work. The excavation shall be maintained in a dry condition and no foundation materials, pipe or concrete shall be placed in the water. Dewatering shall be done in an approved manner such that the subgrade can be trimmed, foundation materials, pipe or concrete placed in the dry, without disturbing bearing materials, and water from the excavation shall be disposed of in such manner that it will cause no injury to property or inconvenience to the public.

Whenever high water tables are encountered and where subgrade consists of soils such as fine silty sands, which are easily disturbed by flowing water, uplift pressures shall be relieved by well points extending as far below the base of the trench as necessary. For subgrades of non-plastic silt or silty fine sand, the groundwater shall be drawn down to a level at least two feet below the final invert grade of the pipe by well points or other approved means.

Care should be taken to shut down dewatering equipment slowly to avoid uplift and softening of the materials supporting the pipe and appurtenances.

3.16 Care must be taken not to move any sewers, drains, culverts, water, gas or other pipes or poles or other structures, and in crossing such pipes or structures, or in running parallel with or near them; they shall be securely hung, braced and supported in place until the work is completed. Whenever it is necessary to interfere with said structures, the Contractor, at his own expense, shall maintain their respective services, and if necessary for that purpose, shall lay temporary water, gas or other pipes, or other structures. The Contractor shall repair all damage done to any of said structures through his acts or neglect, and shall keep them in repair until one year after the completion of the work. He shall leave them in as good condition as they were previous to the commencement of the work.

3.17 In case of a gas, water or other pipe becoming broken in the prosecution of the work, the Contractor shall give immediate notice to the proper authorities, and shall be responsible for any damage to persons or property caused by such breaks, and failure to give prompt notice to the authorities shall make the Contractor responsible for any needless loss of water or gas.

3.18 The trench and other excavations above pipe grade shall be carefully refilled as soon as possible after construction of the pipe line or related structure. No portion of a trench or other excavation shall be backfilled until the structure contained in it has been examined and approved. When, for any reason the work is left unfinished, all trenches and other excavations shall be filled, and the roadways and sidewalks left unobstructed, with their

surface in a safe and satisfactory condition. In unpaved areas, the backfill above the pipe shall be carefully consolidated, in order to prevent settlement. The trench shall be tamped sufficiently to prevent any settlement of or damage to adjacent structures.

3.19 No rock or frozen earth over 10 inches in diameter shall be put in the trench until the refilling has reached at least 2 feet above the top of the pipe lines, and then not unless specifically permitted. All spaces between suitable pieces of rock shall be thoroughly filled with earth by backfilling with alternate layers of rock and earth.

3.20 PIPE-TO-CATCH BASIN CONNECTION: Pipe connections to catch basin shall be mortared into the catch basin with masonry cement. Care shall be taken with a method satisfactory to the Engineer when making holes in existing catch basins to maintain the integrity of the catch basin. The end of all inlet and outlet pipes in concrete storm structures within NYSDOT right-of-ways shall be flush with the inside wall. Outside of NYSDOT right-of-way, inlet pipes may project inside basins as shown on plans. Discharge pipe ends shall be flush with inside wall. All connections shall be watertight. Knockouts are not acceptable.

3.21 Installation shall be in accordance with ASTM Recommended Practice D-2321. When within New York State right-of-way, installation shall conform to NYSDOT Specifications 206 and 18603.9801XX and the NYSDOT standard sheets.

3.22 Do not enter or disturb on-site wetlands while performing work under this section and contract, unless otherwise ordered.

3.23 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and when work stops.
3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. The Contractor shall at all times provide the means necessary to prevent damage to structures, piping, etc., during all phases of construction. Any damage caused during construction shall be replaced, to the satisfaction of the Engineer, at no cost to the Owner.

END OF SECTION 33 40 00

# SECTION 33 40 10

# UNDERGROUND STORMWATER DETENTION

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the contract, including the General and Supplementary Conditions and Division 1 specification sections apply to this section.

### 1.2 WORK INCLUDED:

A. Under this section the Contractor shall furnish and install underground stormwater detention civil works as specified and as shown on the plans.

### 1.3 RELATED SECTIONS

Section 31 23 00: Earthwork
Section 31 23 16: Trenching, Backfilling and Compaction
Section 33 40 00: Storm Sewer Systems

### 1.4 FUNCTIONAL DESCRIPTION:

A. Underground stormwater detention systems shall be designed for H-20 loading conditions. All pipe and fitting connections shall be gasketed and water tight (HDPE) and soil tight (metal pipe).

## PART 2 – PRODUCTS

### 2.1 SUBSURFACE CHAMBER SYSTEM:

A. Chambers shall be Stormtech MC-3500 Chamber Systems as manufactured by ADS or approved equivalent.

1. Size, inverts & layout to be as shown on plans.

B. High density polyethylene (HDPE) pipe with watertight joints, ADS N-12 WT IB pipe or approved equal. Pipe shall meet AASHTO M294, Type S or ASTM F2306.

C. WT IB pipe shall be joined using a bell & spigot joint. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. 12- through 60-inch (300 to 1500 mm) diameters shall have a bell

reinforced with a polymer composite band. The bell tolerance device shall be installed by the manufacturer. Pipe & fitting connections shall be with a bell and spigot connection utilizing a spun-on or welded bell and valley or saddle gasket. The joint shall meet the watertight requirements of ASTM D3212, and gaskets shall meet the requirements of ASTM F477.

D. Fittings shall conform to ASTM F 2306 and meet joint performance indicated above for fitting connections. Custom fittings are available and may require special installation criterion.

PART 3 – EXECUTION

3.1 SYSTEMS UP TO 60" DIAMETER: Installation shall be in accordance with ASTM D2321 and manufacturer recommended installation guidelines, with the exception that minimum cover in non-traffic areas for 12 – through 60-inch (300 to 1500 mm) diameters shall be one foot (0.3 m). Minimum cover in trafficked areas for 12- through 36-inch (300 to 900 mm) diameters shall be one foot (0.3 m) and for 42- through 60-inch (1050 to 1500 mm) diameters, the minimum cover shall be 2 ft (0.6 m).

3.2 BACKFILL AND SPACING: Piping shall be spaced at 3' from edge of pipe to edge of pipe, and backfilled with NYSDOT Item 304 Item 4 Processed Gravel. Compact to a minimum of 95% of Modified Proctor density in lifts not exceeding 8". Comply with specifications included in 312316 Trenching, Backfilling and Compaction.

END OF SECTION 33 40 10

# SECTION 33 46 26

# GEOTEXTILE FABRICS

## PART 1 - GENERAL

### 1.1 RELATED WORK

Section 02 10 00: Tree Protection and Trimming.
Section 31 22 13: Rough Grading.
Section 31 23 00: Earthwork.
Section 31 25 00: Sediment and Erosion Control.

### 1.2 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each item specified.

B. Samples: 12 inch x 12 inch sample of prefabricated drainage panel.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Prefabricated Drainage Panel; Any of the Following:

1. MIRADRAIN 6000 by Nicolon/Mirafi Group
2. J-Drain 300 Composite Drainage System by JDR Enterprises, Inc.
3. Hydraway 300 by Monsanto
4. Or approved equivalent

B. Geotextile Woven Polypropylene Reinforcement Fabric:

1. Amoco 2006 by Amoco Fabrics and Fibers Co.
2. Mirafi 500x by Nicolon/Mirafi Group
3. Or approved equivalent

C. Geotextile Filter Fabric:

1. Amoco 4545 by Amoco Fabrics and Fibers Co.
2. Or approved equivalent

## PART 3 - EXECUTION

### 3.1 PROTECTION

A. Protect prefabricated drainage panel from sunlight during transportation and storage.

### 3.2 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions.

END OF SECTION 33 46 26

SECTION 33 56 13

ABOVEGROUND FUEL STORAGE TANKS

PART – 1 GENERAL

1.01 WORK INCLUDED:

A. This section covers furnishing and installation of one (1) 5,000-gallon split (2,000-gallon gasoline and 3,000-gallon diesel) aboveground storage tank (AST). Tank shall be protected type, double wall steel with secondary containment, vehicle impact protection, and projectile resistance. This section also covers the fill piping with spill containment (capable of returning the product to the AST), vent piping with vent caps, associated fuel piping, stage I vapor recovery, and all materials and accessories necessary to make a complete installation ready for use as described herein and as indicated on the Drawings.

B. The Contractor shall furnish all labor, materials, equipment, appliances, services and hauling, and perform operations in connection with the construction and installation of the gasoline tank installation. Work shall be as herein specified and as denoted on the accompanying Drawings.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 33 23, SUBMITTALS

C. Section 31 00 00, EARTHWORK

D. Section 03 30 00, CAST-IN-PLACE CONCRETE FOR FUEL ISLANDS

E. Section 28 09 50, FUEL DISPENSERS AND FUEL MANAGEMENT SYSTEM

F. Section 28 40 00, TANK GAUGING INSTRUMENTATION AND CONTROLS

G. Division 26, ELECTRICAL

1.03 QUALITY INSURANCE:

A. Installation Contractor shall be certified in writing by the manufacturer. The Contractor shall, prior to any installation, submit copies of such certification to the Fire Chief at the local Fire Department and to the Engineer.

B. All additional certificates and test reports specified herein shall be submitted to the Engineer.

C. Protected tank shall be double-wall steel and provide secondary containment by an impervious steel outer wall, UL labeled, constructed to meet governing standards with certification plate (UL Label) affixed and manufactured in the USA.

D. Protected tank shall be designed and manufactured of steel or its equivalent in accordance with approved engineering standards.

E. All tank(s) shall be equipped with an overfill prevention and shall meet NFPA 30 and NFPA 30A requirements.

F. The Contractor shall notify Owner and Fire Department in advance of setting date of ASTs to view pre-installation testing.

G. All ASTs, equipment, and piping materials shall be physically inspected, and pressure tested before being installed. Any defects observed shall be immediately brought to the attention of the Engineer. It shall be the sole responsibility of the Contractor to correct any deficiencies with the manufacturer, in strict accordance with manufacturer's' recommendations, at no additional cost to the Owner.

H. The Contractor shall be a licensed AST installer in the State of New York, and certified by the AST manufacturer, during the entire duration of the project. The Contractor shall have the responsibility of notifying and coordinating with all local and state officials, including the local Fire Department. The Contractor shall pay all inspection, permit, testing, and registration fees in order to provide a complete and fully permitted and operational system along with obtaining the required registrations and permits. The Contractor shall provide a written site safety plan.

I. Contractor shall be responsible for paying for and obtaining all necessary permits and approvals necessary for a complete and operable system.

J. The system shall be explosion proof and grounded in accordance with local, state, federal and manufacturer's requirements.

1.04 REFERENCES:

A. The following standards form a part of this specification and indicate the minimum standards required:

<u>American National Standards Institute (ANSI)</u>

ANSI B1.20.1 General Purpose Pipe Threads

American Society for Testing Materials (ASTM)

| | |
|---|---|
| ASTM D1248 | Polyethylene Plastic Molding and Extension Materials |
| ASTM D1785 | Polyvinyl chloride (PVC) Plastic Pipes, Schedules 40, 80 and 120. |
| ASTM A53 | Pipe, steel, black and hot-dipped, zinc coated welded and seamless. |
| ASTM D2996 | Filament Wound Reinforced Thermosetting Resin in pipe. |

Underwriters Laboratories, Inc.

| | |
|---|---|
| UL 142 | Steel Aboveground Tanks for Flammable and Combustible Liquids |
| UL 971 | Non-metallic pipe and UL Standard 567-89 pipe connections for flammable and combustible LP gas |
| UL 1709 | Rapid Rise Fire Tests of Protection Materials for Structural Steel |
| UL 2080 | Fire Resistant Tanks for Flammable and Combustible Liquids |
| UL 2085 | Protected Aboveground Tanks for Flammable and Combustible Liquids |

National Fire Protection Association (NFPA)

| | |
|---|---|
| NFPA 30 | Flammable and Combustible Liquids Code |
| NFPA 30A | Code for Motor Fuel Dispensing Facilities and Repair Garages |
| NFPA 70 | National Electrical Code |
| NFPA 78 | Lightning Protection Code |

The American Welding Society (A.W.S.)

| | |
|---|---|
| A.W.S. | Standard for continuous weld |

Uniform Fire Code (UFC)

| | |
|---|---|
| UFC 1997 | Protected" AST criteria as per Appendix II-F, including ballistics protection. |

California Air Resources Board (CARB)

| | |
|---|---|
| CARB | Testing requirements for air emissions. |

Southern Building Code Congress International (SBCCI)

| | |
|---|---|
| SBCCI | Standard Fire Prevention Code. |

Building Officials and Code Administrators (BOCA)

| | |
|---|---|
| BOCA 1993 | National Fire Prevention Code. |

B. All tanks and piping shall be properly installed in accordance with the manufacturer's instructions and "Petroleum Equipment Institute Publication RP200; Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling".

C. Where differences exist between standards, the Contractor shall use the most conservative. If in doubt, describe differences in writing to the Engineer for his approval before performing the work.

D. The codes and standards listed are the latest as of this publication. Codes and standards are continuously updated. The Contractor shall confirm the construction standard edition enforced by the authority having jurisdiction.

E. Tanks shall be warranted for a minimum period of 30 years against failure due to internal/external corrosion or structural failure.

F. Tanks shall also meet all State requirements including 2020 Fire Code of New York State.

1.05 SUBMITTALS: IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 01330 SUBMITTALS SUBMIT THE FOLLOWING:

A. Shop drawings, details, data sheets, and other descriptive drawings and materials as may be required to fully describe the equipment proposed and verify conformance with the contract documents. Drawings shall include all critical dimensions, locations of fittings and accessories, i.e.: man-way, secondary containment, etc.

B. Shop drawings of the tank(s) by the tank manufacturer including product data sheets and descriptive material for major components to be provided.

C. Assembly and installation drawings.

D. Manufacturer's literature/O&M manual including manufacturer's current installation instructions.

E. Submittals shall be delivered to the Engineer within 10 days of Notice to Proceed. The Engineer shall review the drawings and return them to the Contractor approved, or with appropriate comments, as described in Section 1330 Submittals.

PART 2 – PRODUCTS:

2.01 ACCEPTABLE MANUFACTURERS:

A. The one (1) 5,000-gallon split rectangular aboveground, protected storage tanks shall be double walled steel and UL 2085 listed as manufactured by Highland Tank and MFG. CO.), or approved equal.

B. The primary product pipe shall be as manufactured by Wheatland Tube Company of Sharon, PA, or approved equal.

2.02 FUEL STORAGE TANKS - GENERAL:

A. Provide one (1) protected, aboveground split storage tank (AST) with secondary containment, fittings and accessories as denoted on the drawings. Nominal capacity of the tank shall be 5,000-gallons (2,000-gallon gasoline / 3,000-gallon diesel). Nominal dimensions of the tank shall be: 23-feet-5-inches x 6-feet x 6-feet (L x W x H) and shall have 24-inch diameter manways per Drawings. The tanks shall be chemically inert to petroleum products and shall be capable of storing gasoline and diesel fuel, at ambient temperatures with specific gravities of up to 1.1.

B. The tanks shall be designed to support accessory equipment as denoted on the drawings when installed according to manufacturer’s recommendations and limitations. In addition to all equipment and standard operating loads, the tanks shall be designed for a ground snow load of 80 psf, or shall meet local/state building codes, whichever is greater.

C. The tanks shall be designed for aboveground storage of flammable and combustible liquids at atmospheric pressure. Tank shall include integral steel secondary containment and thermal insulation that provides a minimum two-hour fire rating. Each tank shall be delivered as a complete UL-listed assembly with two factory supplied, welded-on saddles. Size and location of saddles shall be as required by Highland Tank. Saddles to be set level on a solid foundation. Tank shall be designed for possible relocation at a future date. Tank shall comply with the latest edition of National Fire

Protection Association NFPA 30 Flammable and Combustible Liquids Code. The tank's secondary containment must be tested for tightness in the factory and in the field before commissioning. Tank shall be supplied with emergency vents for the primary and the secondary containment tanks. Emergency venting by "form of construction" is not equal and will NOT be permitted.

D. Inner and Outer Tanks shall be manufactured in accordance with UL-142 Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids. Entire tank shall be labeled for Underwriters Laboratories UL 2085 Standard for Insulated Secondary Containment Aboveground Tank for Flammable Liquids. The tank design shall comply with UL 2085 "Protected" Tank standard and shall be tested for Ballistics, Impact, Hose Stream, and Pool Fire UL-2085 performance standards. Tank shall be manufactured and labeled in strict accordance with Steel Tank Institute (STI) Fireguard® Thermally Insulated, Double Wall Steel Aboveground Storage Tank standards as applied by a licensee of the STI. Tank shall be subject to the STI's Quality Assurance program and shall be backed by the STI 30-year limited warranty.

E. Tanks shall be fabricated per UL-142 of mild carbon steel with shell seams of continuous lap weld construction. Tank shall be of double wall construction and provide complete secondary containment of the primary storage tank's contents by an impervious steel outer wall. A 3-inch minimum thickness of porous, lightweight monolithic thermal insulation material shall be installed at the factory within the interstitial space between the inner and outer wall. Thermal insulating material:

   a. Shall be in accordance with American Society of Testing Materials (ASTM) Standards C-332 and C-495.

   b. Shall allow liquid to migrate through it to the monitoring point.

   c. Shall not be exposed to weathering and shall be protected by the steel secondary containment outer wall.

F. Lifting lugs shall be provided at balancing points to facilitate handling and installation.

G. Threaded fittings with thread protectors shall be supplied as shown in detail 8 on drawings FE202 (all fittings must be located on tank top per UL):

H. Installation and testing shall be in strict accordance with Steel Tank Institute Installation and Testing Instructions for Thermally Insulated, Lightweight, Double Wall Fireguard® Aboveground Storage Tanks.

I. The exterior of the tank shall be protected with a three-part exterior coating. The protective coating shall be comprised of Chemzinc 1000 (zinc-rich polyurethane primer), Chemprime 3001 (corrosion Resistant epoxy primer) and a finish coat of Chemthane 3300 (Acrylic polyurethane coating). Final coating shall be white to meet the current Stage I vapor recovery requirements.

J. Tanks shall be manufactured to provide positive drainage on top of tanks, to allow water to shed off the top of the tanks.

2.03 PIPING SYTEM:

A. Fuel piping shall be 1-1/2-inch minimum Schedule 40 carbon steel pipe per manufacturer recommendations and painted in accordance with manufacturer recommendations to protect it from corrosion for outdoor use, in a color chosen by the Owner.

B. Vent pipes shall be installed as shown on the Drawings. They shall be carried up to a point not less than 12 feet above the ground level at the filling point of the tank, shall terminate not less than 5 feet from any door or window opening, and shall be fitted with an approved weather hood screened with noncorrosive wire not coarser than 30 mesh, along with Stage I pressure/vacuum fittings.

C. Tank(s) storing class IB liquids (gasoline) shall be atmospherically vented to prevent development of vacuum or pressure, with Stage I PV fittings.

D. All aboveground tanks shall have emergency relief venting that will relieve excessive internal pressure caused by an exposure fire. This requirement shall also apply to the interstitial space of the secondary containment tank. Vent types and size shall be in accordance with NFPA, manufacturer, and UL listing requirements.

E. All metallic piping, fittings, and valves used in connection with approved nonmetallic piping, fittings, and valves shall be grounded in accordance with local and state regulations, and manufacturer's recommendations.

F. Pipe and fittings smaller than 2-inches shall be carbon steel. Pipe joints shall be threaded pipe and fitting threads and shall conform to ANSI B1.20.1.

G. All fittings shall be Schedule 40, minimum.

H. Brass seated unions shall be installed where deemed necessary by the Engineer for future maintenance and repairs.

I. Entire fuel system shall be grounded per State and Federal requirements.

2.04 ACCESSORIES:

A. An electric level gauge and monitoring system shall be provided for each tank, with remote reading located as shown on the Drawings, and in Section 28 40 00 Tank Gauging Instrumentation and Control.

B. A hardwood dipstick shall be provided for each tank of appropriate length for local level readings.

C. System shall be complete with valves to prevent all siphoning of fuel.

D. Overfill protection shall be provided by the following methods:

a. Overfill prevention valve as manufactured by OPW or approved equal. Direct reading level gauge visible from fill pipe access. Visual level clock gauge shall be as manufactured by Morrison, Inc. or approved equal and located near the fill port for easy monitoring.

E. The tank shall be equipped with (2) 10-gallon remote fill boxes. The remote fill boxes shall be installed on the tank pad on each side of the tank as shown on the drawings. The units shall include the following:

a. Box and Door: 14-gauge steel with a white powder coat finish.
b. Stainless steel ball valve
c. Stainless steel quick disconnect coupler and plug
d. Anodized aluminum quick disconnect adaptor and cap
e. Stainless steel dry disconnect adaptor and cap
f. Remote fill box shall be as manufactured by Morrison Bros. Model 715 series or approved equal.

F. The fuel port and fill piping for the ASTs shall be 2-inch minimum and shall come equipped with a drop tube which will deliver fuel to the bottom of the tanks in accordance with manufacturer recommendations and NFPA requirements. In addition, the fill pipe shall be equipped with an overfill prevention valve rated for pump deliveries which will automatically shut the flow of fuel off to the tanks at a pre-determined height, overfill prevention valve shall be OPW 61 F Stop or equal. The tank vent diameter shall be at least as big as the tank fill pipe. Contractor shall notify engineer when overfill prevention valve is being installed.

G. The product level and interstitial space shall be monitored in accordance with Section 28 40 00 Tank Gauging Instrumentation and Controls.

H. The fill pipes and vapor recovery piping shall be equipped with poppet valves so the tank can be tested for stage I vapor recovery with the cap off.

## PART 3 – EXECUTION

### 3.01 INSTALLATION:

A. Manufacturer will have a minimum of 5-years' experience in producing specified tanks for commercial use and document at least 10 installations in satisfactory operation.

B. The tanks shall be installed in accordance with manufacturer's recommendations and in accordance with local, state, and federal regulations.

C. Tanks shall be installed on a reinforced concrete base slab, as detailed on the Drawings, designed to support the fully loaded tank.

D. Tanks shall be marked on all sides with warning signs per local, state and federal requirements including, but not limited to: “FLAMMABLE” or “COMBUSTIBLE”, “NO SMOKING”, product identification and other signs as required by Local, State, and Federal regulations.

E. Electrical work shall be in accordance with applicable codes, including NFPA, and shall be rated for a hazardous area as required. Electric feed for dispensing pumps shall include an emergency shutoff switch located a minimum of 20-feet, maximum of 100-feet away per code requirements. Tanks shall be electrically grounded in accordance with NFPA 78. All electrical work shall be performed by a NY licensed electrician.

F. The system installation shall be inspected and approved by the system supplier or its certified contractor. The system supplier shall submit a comprehensive checklist of quality and safety items critical to the system and verify that the installation has been in accordance with these standards and applicable Local, State, and Federal regulations.

G. Monitoring systems shall be installed as indicated in Section 28 40 00 Tank Gauging Instrumentation and Controls.

H. The Specifications and Drawings indicate the general components of the fuel system only and the Contractor shall be responsible for providing all other materials, equipment, components, and labor as needed to provide a complete, code compliant and operational system. All components of the system shall be coated or otherwise protected as approved by the Engineer to prevent corrosion and all components shall be waterproof and rated for use in an outdoor environment (weatherproof).

I. The entire fuel system, including components specified in other sections, shall have a one-year warranty guaranteeing the system shall operate trouble free for one year following acceptance by the Owner. The Contractor shall be responsible for performing all repairs and replacing equipment/components as necessary during the warranty period to ensure trouble free operation at no additional cost to the Owner.

J. The gasoline tank shall be equipped with Stage I vapor recovery equipment so that vapors can be collected during tank filling. The Tank shall be painted white per manufacturer’s requirements.

K. The Contractor shall train the Owner in the use of the Fuel System.

3.02 TESTS:

A. The tank and piping shall be inspected for damage and external defects, tested for tightness.

B. Tanks and piping shall be pressure tested in accordance with local, state and federal requirements, including NFPA 30 and 30A, at a minimum. Primary steel tank shall be pressure tested at 5 psig for a minimum of 24 hours or per manufacturer or NFPA 30 and 30A requirements.

C. All equipment necessary to perform the required tests shall be furnished by the Contractor. Contractor is responsible for coordinating the testing with the fire department and obtaining necessary approval to allow the system installation and operation.

END OF SECTION

P:\NY\Ardsley, Village of\Ardsley DPW\Industrial Design\Specifications\33 56 13 Fuel Station - Above Ground Storage Tank (new tanks).docx

# SECTION 34 41 13

# TRAFFIC SIGNS

## PART 1 - GENERAL

### 1.1 SUBMITTALS

A. Shop Drawings: Show shop drawings, not necessarily to scale, but sufficient enough in detail to show color, wording, lettering size and style, overall sign size, construction details and installation details for each type of sign.

## PART 2 - PRODUCTS

### 2.1 TRAFFIC SIGNS

A. All signs shall be compliant with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition, unless otherwise noted.

B. Construction Materials: Comply with the applicable requirements of DOT Section 645.

C. Posts: Galvanized steel.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Erect signs in their designated locations, as indicated and in accordance with the approved shop drawings and the applicable requirements of DOT Section 645.

B. Protect surfaces and finishes from abrasion and other damage during handling and installation.

C. Replace damaged or faulty signs.

END OF SECTION 34 41 13

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# Geotechnical Engineering Report

**Proposed DPW Facility**
**220 Heatherdell Road**
**Ardsley, New York**
October 2, 2020
Terracon Project No. JB205051

**Prepared for:**
Weston & Sampson, PE, LS, LA, PC
Albany, NY

**Prepared by:**
Terracon Consultants-NY, Inc
Dba Dente Group
Albany, New York

October 2, 2020

Weston & Sampson, PE, LS, LA, PC
1 Winners Circle, Suite 130
Albany, NY 12205

Attn: Mr. Jeffrey Budrow, P.E.
p: (518) 463-4400
e: budrowj@wseinc.com

Re: Geotechnical Engineering Report
Proposed DPW Facility
220 Heatherdell Road
Ardsley, New York
Terracon Project No. JB205051

Dear Mr. Budrow:

We have completed the Geotechnical Engineering services for the referenced project. This study was performed in general accordance with Dente Group proposal no. PJB205051 which was authorized on or about June 2, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We appreciate the opportunity to be of service to you. If you have any questions concerning this report or if we may be of further service, please contact us at your convenience.

Sincerely,
**Terracon Consultants-NY, Inc.**

John S. Hutchison, P.E.
Senior Engineer

Joseph Robichaud, Jr., P.E.
Sr. Associate / Office Manager

## REPORT TOPICS

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**Note:** This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

## ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

**Note:** Refer to each individual Attachment for a listing of contents

# Geotechnical Engineering Report

## Proposed DPW Facility

## Ardsley, New York

**Terracon Project No. JB205051**

**October 2, 2020**

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Department of Public Works (DPW) facility at 220 Heatherdell Road in the village of Ardsley, Westchester County, New York. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Pavement design and construction
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per NYSBC
- Frost considerations

The geotechnical engineering scope of services for this project included the advancement of 13 conventional test borings to depths ranging from 6.1 to 20.6 feet below existing site grades. Of these, ten of the borings were completed within proposed building footprints, while the remaining three were completed in proposed pavement or bulk storage areas. Infiltration testing was performed at four of the borehole locations. The scope of services also included a limited laboratory testing program, a slope stability evaluation and preparation of this summary report.

Maps indicating the site and test boring locations are included as the attached **Site Location** and **Exploration Plan**, respectively.

## SITE CONDITIONS

Existing conditions at the site are summarized in the following table:

| Item | Description |
|---|---|
| **Parcel Information** | The project site is located at 220 Heatherdell Road in Ardsley, NY. Approximate geographic coordinates: 41.0181° N, 73.8255° W. The subject parcel is some 2.9 acres in size. |
| **Existing Improvements** | Three-story wood frame house, along with one story garage and two smaller sheds (one stone, one metal). Plans provided to us indicate some buried or at-grade features on the site such as a vault and septic tank along with concrete and stone pads. |

| Item | Description |
|---|---|
| **Current Ground Cover** | Includes an asphalt paved drive and parking area, along with landscaped grounds. A pond is located west of the entrance drive, and some portions of the site are wooded/brushy. |
| **Existing Topography** | The site is situated north of Heatherdell Road and west of Sprain Brook and the Sprain Brook Parkway. Existing grades run from a high of about elevation 283 feet at the north end of the site to about elevation 262 feet around the pond, and are lowest at the southeast corner where an outlet structure for a culvert which carries water from the pond is located (invert elevation of culvert at outlet is 253.82 feet). Along the east side of the site, grades slope down between the elevations of about 275 and 250 feet to meet Sprain Brook (another stream runs along the south property boundary). Ground surface in front of the existing house was observed to be somewhat hummocky. |
| **Geology** | Review of available geologic mapping indicates that overburden soils in the site locale consist of glacial till. The geologic mapping also describes bedrock underlying the project area as dolomite marble, calc-schist, granulite and quartzite, overlain by calcite marble. |

An access easement runs through the site, providing right-of-way to the north adjoining property.

Review of available historical aerial imaging and topographic mapping indicates the existing house dates from the 1930s. No development pre-dating the existing house is evident on maps dating back to 1892.

It is noted that as recently as 2007, the pond extended eastward to the driveway, and an apparent spillway or apron was located immediately downstream, east of the driveway. It appears the spillway/apron feature has been filled in, with the means of outlet for the pond now a buried 48-inch culvert discharging at the site's southeast corner as noted above.

## PROJECT DESCRIPTION

Our understanding of the project is summarized as follows:

| Item | Description |
|---|---|
| **Information Provided** | ■ Boundary & Topographic Survey by Tectonic, dwg. no. SU-101 dated 12/02/2019<br>■ Conceptual Site Plan by Weston & Sampson, dwg. no. C100 dated 6/02/2020<br>■ Topographic cross sections through east slope by Weston & Sampson, dwg. no. C300, 8/20/2020 progress print |

| Item | Description |
|---|---|
| **General Description** | Project entails demolition and removal of the existing house, garage and sheds, and construction of a new DPW facility. The existing pond will remain in place. |
| **Proposed Structure(s)** | As we understand it, plans call for a new one to two story building with a footprint of approx. 28,000 sq.ft., with space for administration and staff, shops, vehicle storage and vehicle maintenance. The building will be slab-on-grade with no basement. Also planned is a single story, slab-on-grade salt storage building (approx. 2,000 sq.ft.), outdoor bulk storage areas, and a fuel island. |
| **Building Construction** | Not specified. Steel frame, masonry clad and/or pre-fabricated metal type assumed. |
| **Maximum Loads** | Foundation loads not expected to exceed 73 kips axial and 56 kips lateral at the top of piers. We have assumed that floor loads will not exceed 250 pounds per square foot. |
| **Finished Floor Elevation** | Finished floor throughout much of the main building planned at approx. elev. 278.5 feet, with the floor at approx. elev. 272.5 feet in the administration/staff area and at approx. elev. 275.5 feet in the vehicle wash bay. Finished floor of the salt storage building to be set at approx. elev. 275.0 feet. Planned grades in the proposed paved drive/parking and main yard area between the elevations of about 270 and 275 feet. |
| **Grading/Slopes** | Proposed grading plans indicate that cuts upwards of about 5 feet and new fills upwards of about 9 feet will be required to establish proposed grades in the building and pavement areas. |
| **Below-Grade Structures** | Two underground fuel storage tanks (USTs) are anticipated in the fueling area. |
| **Free-Standing Retaining Walls** | Low retaining walls upwards of approx. 4.5 feet in height and about 275 feet in total length are planned. |
| **Pavements** | In addition to passenger cars and light trucks, it is assumed new pavements will be subject to regular use by heavy highway maintenance trucks and bulk loading/unloading equipment in the yard. |

If any of the above information is incorrect, please let us know so we can review the conclusions and recommendations provided in this report for applicability to the actual design and update the report as appropriate.

As the design of the project progresses and site grading plans and building loads are fully developed, we should be retained to assess this site-specific information relative to the recommendations contained herein.

# SUBSURFACE CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration results, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical analysis and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual subsurface logs. The logs can be found in the **Exploration Results** and the GeoModel in the **Figures** sections of this report.

## Subsurface Profile

The following model layers were identified within the subsurface profile. For a more detailed view of the model layers with depths at each boring location, refer to the GeoModel.

| Model Layer | Layer Name | General Description |
|---|---|---|
| **1** | **Fill** | Typically silts and sands with lesser amounts of foreign matter (e.g., fragments of brick, concrete, asphalt, coal, etc.) |
| **2** | **Native Sand & Silt** | Varying proportions of sand and silt with lesser amounts of gravel |
| **3** | **Glacial Till** | Typically silt and fine sand with embedded coarser sands, gravel |
| **4** | **Bedrock** | Schist, weathered and decomposed |

Topsoil between roughly 0.4 and 1.0-foot-thick was present at the ground surface at most of the test boring locations (10 of 13), while asphalt pavement between approximately 0.2 and 0.3 feet thick was present at the ground surface at boreholes B-5 and B-7. The pavement was underlain by an aggregate base course about 0.4 feet thick at borehole B-5, and by a topsoil-like material at B-7. No distinct surface material was noted at the B-11 location. We note the indicated topsoil thicknesses should be regarded as rough approximations only, and should not be relied upon for construction quantity estimates. Contractors are advised to make their own estimates or determination of topsoil thickness and quality for bidding purposes.

Beneath whatever surface materials were present, fill soils were identified at about a third of the locations investigated (4 of 13), extending to depths of about 2 to 6 feet or more below existing site grades. The existing fills were found to consist generally of silts and sands in varying proportion, along with relatively minor amounts of foreign matter such as brick, concrete, asphalt and/or coal. At test boring B-11, the relative proportion of foreign material/rubble in the fill was greater, and cobbles were noted therein (the fill at B-11 was not penetrated at the borehole termination depth of 6.1 feet). The relative density of the fill as indicated by measured SPT N-values was typically dense to very dense where essentially granular, and soft to medium stiff where fine-grained soils were prevalent.

Native soils beneath the existing surface and/or fill materials were generally composed of silts and sands in varying proportion along with lesser amounts of gravel. In places, the native soils exhibited the characteristics of glacial till with depth. Where essentially granular, the native soils

were typically medium dense to dense in relative density, and where primarily fine-grained, were typically medium stiff to very stiff in consistency (note however the upper few feet of soils at borehole B-1 were determined to be relatively soft on the basis of the SPTs).

Weathered and decomposed schist bedrock was encountered at depths ranging from approximately 9 to 16.5 feet at the test boring locations. While spoon refusals were common in the weathered rock, the material was nonetheless penetrable to depths upwards of several feet or more with the augers used. No bedrock coring was performed.

These findings are substantially similar to those revealed through a test pit investigation by others at the site in 2019, a report of which was provided for our use (Tectonic – January 31, 2019).

### Groundwater Conditions

Groundwater measurements were made (or attempted) as the boreholes were advanced and are reported on the attached subsurface logs. Based on these measurements and the recovery of wet soil samples, it appears that groundwater was intermittently present across the site at the time of investigation, but was most prevalent and shallowest on the site's west side, nearest the pond and where existing grades are lower in elevation.

Groundwater on the west side of the site was found as shallow as two to three feet below the existing ground surface (bgs) in the test borings, while groundwater was encountered no shallower than six feet on its east side. The test pit investigation by others also revealed that groundwater was generally shallower on the site's west side (4 to 8 feet bgs) as compared with its east side (9 to 10 feet bgs).

In general, it seems groundwater encountered on the site's west side represents a water table condition, while water on the east side is for the most part locally perched or trapped. Groundwater conditions, and the extent of any perched water, should be expected to vary with seasonal fluctuations in precipitation and runoff. Additionally, grade adjustments on and around the site may affect the water table, as may drainage improvements on the site and surrounding properties.

## INFILTRATION TESTING

Infiltration testing was performed adjacent to test borings B-8, B-11, B-12 and B-13. The tests were designated with an "I" prefix and numbered correspondingly with the boreholes. The testing was conducted in general accordance with the guidelines in Appendix D of the NYS Stormwater Management Design Manual. Results of this testing are presented for your use in the **Exploration Results** attachment and summarized in tabular form below.

| Location | Test Depth (ft) | Soil Description | Infiltration Rate (in/hr) |
|---|---|---|---|
| I-8 | 4.0 | Silt with sand, trace gravel (moist) | nil |
| I-11 | 4.0 | Fill: Sandy silt and concrete (moist) | 4.8 |
| I-12 | 1.5 | Silty sand, trace gravel (wet) | 9.3 |
| I-13 | 2.5 | Fill: Sandy silt (moist to wet) | 0.8 |

Note: The infiltration rates indicated above represent the result of the last trial run at each test location.

## GEOTECHNICAL OVERVIEW

The project site is considered generally suitable for support of the proposed buildings using conventional shallow spread foundation and slab-on-grade design, although the presence of existing fill soils and shallow groundwater in places will impact on planning for design and construction. Based on the conditions disclosed by our investigation, we offer the following general conclusions.

- New foundations and floor slabs may be supported on undisturbed native soils, or on imported structural fill which is placed over the native soils after all existing fills and remains of former structures are removed, along with any otherwise unsuitable materials which may be found. Existing fill soils should not be relied upon for new foundation support.

- If existing fills throughout the site are similar in composition to those found in the test borings, consideration may be given to support of new pavements over the existing fills provided the subgrade surfaces are proof-rolled and stabilized as may be required. It should be understood the proof-rolling will lessen, but not eliminate, the possibility that settlement of pavements constructed over the existing fills may occur over time and require periodic maintenance.

- The soils excavated onsite should generally be suitable for reuse as fill and backfill once cleansed of any oversized particles, unsuitable debris or organics, subject to the approval of the Geotechnical Engineer and based upon the conditions encountered at the time of construction.

- In general, groundwater is expected to be below foundation excavation depths and should not be a significant factor in planning for design and construction of the building(s). However, the proposed petroleum USTs should be designed cognizant of the shallow groundwater identified in that area of the site. If the tanks will be seated below about elevation 268 feet, they should be designed to resist hydrostatic uplift forces when empty, and temporary dewatering will likely be required for their construction. Dewatering is a means and methods consideration for the contractor.

The following sections of this report provide more detailed recommendations to assist in planning for the geotechnical aspects of the project. We should be provided with the opportunity to review plans and specifications prior to their release for bidding to confirm that our recommendations were properly understood and implemented, and to allow us to refine our recommendations, if warranted, based upon the final design. The **General Comments** section provides an understanding of the report limitations.

## SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC).

### Seismic Site Classification

In our estimation, the seismic Site Class is C. This classification is made based upon the results of standard penetration testing at the site and shear wave velocity testing completed in similar subsurface profiles in the region. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth, if desired.

## EARTHWORK

Earthwork is anticipated to include demolition of the existing building(s), clearing and grubbing, removal of existing pavements, stabilization of subgrade surfaces as necessary, foundation excavation and associated site fill and backfill. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered suitable in our geotechnical engineering evaluation for foundations, floor slabs and pavements.

If the owner elects to leave the existing fills in place beneath new pavements, proof-rolling and stabilization of the subgrades as described below will lessen but cannot eliminate the risk of settlement. If this risk cannot be accepted, the existing fills should be removed and replaced in their entirety as part of the site preparation.

Construction site safety is the sole responsibility of the contractor, who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility is neither implied nor shall it be inferred.

## Site Preparation

Site preparation should begin with demolition of the existing buildings, along with stripping of existing topsoil, surficial organic matter and pavements as applicable from the proposed building and pavement areas. All existing fills, old building foundations, slabs or below grade structures should be removed in their entirety from beneath the proposed building area, extending at least five feet beyond its perimeter. Attention should be paid to the hummocky grades in front of the existing house (its south side). Outside the proposed building area, any foundation remains or old structures should be removed to a depth of at least two feet below new pavement surfaces.

Prior to placing fills to raise site grades, and/or after cuts are made to the plan subgrade elevations, the subgrades should be proof-rolled/proof-compacted using a steel drum roller with a static weight of at least seven tons. The roller should operate in its vibratory mode, unless requested otherwise by the Geotechnical Engineer observing the work, and travel at a speed not exceeding three feet per second (two miles per hour). The roller should complete at least two passes over all subgrade surfaces in opposing directions. The method of proof-rolling may be modified by the Geotechnical Engineer based upon the conditions revealed at the time of construction.

Soft areas identified by the proof-rolling should be investigated to determine the cause and stabilized accordingly. These investigations may include the excavation of test pits. If existing fills are found and determined by to be unsuitable by the Geotechnical Engineer, they should be removed and replaced as deemed necessary.

## Fill Material Types

Structural Fill should be used as fill/backfill within the proposed building and pavement areas. The fill should consist of imported sand and gravel which meets the limits of gradation given below. Any imported materials should be free of recycled concrete, asphalt, bricks, glass, and pyritic shale rock.

**IMPORTED STRUCTURAL FILL**

| Sieve Size | Percent Finer |
|---|---|
| 3” | 100 |
| ¼” | 30 to 75 |
| No. 40 | 5 to 40 |
| No. 200 | 0 to 10 |

As previously noted, the reuse of excavated native soils and/or existing fill materials may be considered if approved by the Geotechnical Engineer and pending the conditions encountered at the time of construction. Any reuse of the onsite soils would require that any excessively silty

material, organics, oversized particles or unsuitable foreign matter found therein be separated and reused in landscape areas only or wasted off-site as appropriate.

## Fill Compaction Requirements

Fills beneath the building pad and pavements should be placed in uniform loose layers no more than about one-foot thick where heavy vibratory compaction equipment is used. Smaller lifts should be used where hand operated equipment is required for compaction. Each lift should be compacted to no less than 95 percent of its maximum dry density as determined by the Modified Proctor Compaction Test, ASTM D1557. In landscape areas, the compaction requirement may be relaxed to 90 percent of maximum dry density.

## Grading and Drainage

All grades must provide effective drainage away from the new buildings during and after construction and should be maintained throughout the life of the structures. Water retained next to buildings can result in soil movements greater than those indicated in this report, which may in turn result in unsatisfactory differential floor slab and/or foundation displacements, cracked slabs and walls, or roof leaks.

## Temporary Excavation Slopes

Excavations must be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P and its appendices, along with any state and local codes, as applicable. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed OSHA regulations. Flatter slopes than those stipulated by the regulations or temporary shoring may be required depending upon the soil conditions encountered and other external factors. OSHA regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties.

## Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of topsoil and unsuitable fills, proof-rolling, and mitigation of any areas identified as needing improvement through proof-rolling. Each lift of new compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts.

Foundation bearing grades and subgrades for floor slabs, pavements and concrete pads should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

It should be understood that subsurface conditions will be more fully known when the site is excavated. The continuation of the Geotechnical Engineer into the construction phase of the project will allow for validation of the subsurface conditions assumed to exist for this study and in the development of the design recommendations in this report, along with assessing any variations, providing interim recommendations as necessary and reviewing associated design changes.

## SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted previously in **Earthwork** and below under the **Foundation Construction Considerations**, the following design parameters may be assumed.

### Design Parameters – Compressive Loads

| Item | Description |
|---|---|
| **Maximum Net Allowable Bearing Pressure** [1, 2] | 3,000 pounds per square foot (psf) |
| **Required Bearing Stratum** [3] | Undisturbed native soils or structural fill placed over the native soils after removal of existing fills |
| **Minimum Foundation Dimensions** | Columns: 36 inches<br>Continuous: 24 inches |
| **Ultimate Coefficient of Sliding Friction** [4] | 0.35 (concrete on native soils)<br>0.45 (concrete on imported structural fill) |
| **Minimum Embedment below Finished Grade** [5] | Exterior footings: 48 inches<br>Interior footings in heated areas: 24 inches<br>Interior footings in unheated areas: 48 inches |
| **Estimated Total Settlement from Structural Loads** [2] | Less than about one (1) inch |
| **Estimated Differential Settlement** [2, 6] | About 75% of total settlement |

| Item | Description |
|---|---|
| 1. | The maximum net allowable bearing pressure is the pressure which exceeds the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. |
| 2. | Values provided are for maximum loads noted in **Project Description**. The settlements should occur relatively quickly as construction is completed and each load increment is applied. |
| 3. | The bearing grades should be prepared per the recommendations presented below in the **Foundation Construction Considerations**. |
| 4. | Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. |
| 5. | Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure. Interior footings in heated area may be seated at the 24-inch depth if allowed by local building codes. In the case of haunched floor slab support for interior partition walls, the minimum depth requirement may be waived (again, if permitted by local building codes). |
| 6. | Differential settlements are as measured over a span of 50 feet. |

A perimeter foundation drain should be provided to collect and relieve any water which enters the backfill soils after construction is complete. The drains should consist of nominal four-inch diameter perforated PVC or corrugated HDPE pipe set within ± 12 inches of clean crushed stone composed of ASTM C33 Blend 57 material. The stone should be enveloped with a non-woven synthetic filter fabric meeting NYSDOT standard specifications section 737-01 for drainage geotextile. All drains should be provided with clean outs for their maintenance.

## Foundation Construction Considerations

The foundations may be seated directly on undisturbed native soils, or on imported structural fill placed over the native soils after removal of all existing fill, along with any remains of former structures or otherwise unsuitable materials that may be found. If over-excavation is required beneath the foundations to remove unsuitable material, the excavation should extend horizontally beyond each side of the foundation a distance equal to at least one-half the depth of the undercut below the final bearing grade elevation. Replacement material should meet the specification and compaction guidelines for structural fill as outlined herein.

Foundation bearing grades should be proof-compacted using a mechanical or large reversible plate tamper to densify the soils loosened by the excavation process unless otherwise directed by the Geotechnical Engineer observing the grades. If groundwater seepage occurs, proof-compacting should be eliminated, and a minimum six-inch thick base of clean crushed stone placed over a geotextile fabric should be provided to establish a more uniform and stable base for construction and to assist in dewatering. The stone should be an ASTM C33 Blend 57 aggregate and the fabric as described above.

All final bearing grades should be relatively firm, stable, and free of loose soil, mud, water and frost. The Geotechnical Engineer should approve the condition of the foundation bearing grades immediately prior to placement of reinforcing steel and concrete.

# FLOOR SLABS

## Floor Slab Design Parameters

As previously indicated, we recommend that all existing fills be removed from beneath new floor slabs in addition to their removal from beneath new foundations and be replaced with structural fill. The floor slabs should be constructed upon a minimum six-inch thick subbase course which conforms to the requirements for NYSDOT Type 2 Subbase or ASTM C33 Blend 57 aggregate. Consideration should be given to using a thicker subbase course in areas subject to heavier loads and/or use, or those exposed to freezing temperatures.

The use of a vapor retarder along with a base course of ASTM C33 Blend 57 aggregate should be considered beneath concrete slabs on grade to be covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding its use and placement.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

Floor slab subgrades should be prepared as outlined in the **Earthwork** section herein. Under these conditions, a modulus of subgrade reaction equal to 150 pounds per cubic inch (pci/in) may be assumed at the top of the stone base layer for slab design purposes.

## Floor Slab Construction Considerations

Even with the base course recommended above, we caution that the subgrades may not support repeated heavy construction traffic or telehandlers without suffering rutting and weaving that may be especially severe during wet seasons. If the grades are to be repeatedly traversed by these types of equipment, they should be reinforced as necessary to support them. Areas which become disturbed or weakened should be excavated and stabilized accordingly.

The Geotechnical Engineer should approve the condition of floor slab or pad subgrades immediately prior to placement of the subbase course. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

# EARTH RETAINING WALL DESIGN

All earth-retaining foundation walls or structures should be designed to resist the lateral pressures generated by earth backfill and any temporary or permanent surcharge loads. Active earth pressures may be assumed for walls that are free to deflect as the backfill is placed and surcharge loads applied. At-rest earth pressures should be assumed for walls that are braced prior to

backfilling or applying surcharge loads. The following design parameters are provided to assist in determining the lateral wall loads, whichever apply:

- Soil angle of internal friction - 30 degrees
- Coefficient of At-Rest earth pressure ($k_o$) - 0.50
- Coefficient of Active earth pressure ($k_a$) - 0.33
- Coefficient of Passive earth pressure ($k_p$) -3.00
- Total unit weight of compacted soil - 125 pcf
- Coefficient of sliding friction - 0.35 (concrete on native soils)
  0.45 (concrete on imported structural fill)

The recommended design parameters assume relatively level grades on either side of the wall, that the wall is backfilled with imported granular fill (reuse of excavated onsite soils for this purpose should be avoided), and that the backfill remains permanently well-drained. Water must not be allowed to collect against the wall unless the wall is designed to accommodate the added hydrostatic pressure. Drainage system recommendations are provided below.

### Subsurface Drainage for Earth-Retaining Walls

Retaining structures should be provided with a foundation level drain which may consist of a nominal 4-inch diameter perforated PVC or corrugated HDPE pipe embedded at the base of a minimum 12-inch wide column of clean crushed stone (e.g., NYSDOT no. 1 and no. 2 size aggregate or ASTM C33 Blend 57 stone). The stone should be enveloped in an appropriate non-woven filter fabric (meeting NYSDOT standard specifications section 737-01 for drainage geotextile) to inhibit siltation. Backfill soils behind the crushed stone drainage layer should consist of imported granular fill. The drain line should be sloped to provide positive gravity drainage to daylight, stormwater system, or to a sump pit and pump.

## PAVEMENTS

### Flexible Pavement Design

The pavement sections presented below were developed in general accord with AASHTO procedures using a reduced subgrade strength and local experience to account for frost, and to keep the anticipated pavement heave and cracking within generally tolerable limits. A subgrade resilient modulus ($M_r$) equal to 5,000 psi has been assumed for design purposes. Our design parameters assume the existing fills will be left in place and stabilized as detailed in the **Earthwork** section of this report. As previously indicated, the Owner must accept some degree of risk for pavement settlement, which may require periodic maintenance, if the existing fills are left in place.

Two conventional pavement sections were developed, a Light Duty section for automobile parking areas and a Heavy Duty section for entrance drives and areas subject to repeated truck traffic.

Note that where usage will be especially severe (e.g., areas which are subject to more frequent or concentrated truck traffic, heavy equipment activity, frequent stationary turning operations, tracked vehicles, etc.) rigid concrete pavement may be a better alternative.

For design purposes, it has been assumed that the pavement design life is 20 years, and that daily equivalent single axle loads (ESALs) are equal to 1 for the Light Duty section and 50 for the Heavy Duty section. If the traffic loads vary from these, we should be provided with the opportunity to refine the pavement section accordingly.

All materials should meet the requirements specified in the latest edition of the New York State Department of Transportation (NYSDOT) Standard Specifications for Construction and Materials.

| Flexible Pavement Design | | | | |
|---|---|---|---|---|
| Layer | Material Description | NYSDOT Item Number | Thickness (inches) | |
| | | | Light Duty | Heavy Duty |
| Top | Asphaltic Concrete | 402.127303 | 1.5 | 1.5 |
| Binder | Asphaltic Concrete | 402.257903 | 2.0 | 3.0 |
| Stone Subbase | Crusher-Run Stone | 304.12 Type 2 | 8 | 12 |
| Granular Subbase | Processed Sand & Gravel | 304.12 Type 4 | - | 12 |
| Fabric | Stabilization Fabric | 207.24 | Single Ply | Single Ply |

Any rigid pavements should be provided with a minimum six-inch thick base of crusher-run stone (NYSDOT Section 304-2.02, Type 2 material) placed over a stabilization fabric. The pavements may be designed assuming a modulus of subgrade reaction equal to 150 pounds per cubic inch at the top of the base layer.

## Temporary Construction Access Roadways

The recommended pavement sections are not designed to support heavy construction traffic which may require thicker sections. The contractor should construct temporary haul routes and construction roadways onsite as appropriate for the weather conditions and the equipment in use, with consideration to the soil conditions encountered in specific areas.

## Pavement Drainage

Accumulation of water on pavement subgrades should be avoided by grading the subgrade to a slope of at least two percent, and/or by providing underdrains. Swales should be provided at the pavement edges for drainage relief. Failure to provide adequate drainage will shorten pavement life.

### Pavement Maintenance

All pavements require periodic care, and preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Settlement of pavements due to consolidation of the existing fills may also occur and require periodic maintenance.

### Frost Considerations

Frost may penetrate beneath sidewalks and pavements and cause them to heave, and resulting displacements may be differential, particularly where sidewalks and pavements meet building doorways and along curbs. To limit the magnitude of heave and creation of such uneven joints to generally tolerable magnitudes for most winters, a 16-inch thick base of ASTM C33 Blend 57 crushed stone should be placed beneath sensitive sidewalk or pavement areas, along with an underdrain to relieve any collected waters. The crushed stone should be separated from the surrounding granular soils with a non-woven synthetic filter fabric meeting NYSDOT standard specifications section 737-01 for drainage geotextile.

## SLOPE STABILITY EVALUATION

An evaluation of global slope stability was made on the east side of the proposed main building, where grades slope down to meet Spain Brook. Two inferred sections were analyzed, their locations are approximately shown on the **Exploration Plan**.

In developing each section, the proposed building was included at the top of the slope with the foundation set at an assumed elevation of 272 feet. Structural fill was added as necessary to support the foundations and/or as foundation backfill extending down the slope at an inclination of 1V:2H to meet existing grade. Existing topography was taken from the site plans furnished to us, and the subsurface profile was compiled from information obtained in the test borings and our site observations.

The slope and foundation geometries were analyzed by inputting data from the inferred subsurface profiles into the global stability evaluation software, SLOPE/W by GEO-SLOPE International, Ltd. Typical engineering properties for the soils were selected based on our local experience. Groundwater was modeled as the existing static conditions encountered during our subsurface investigations.

Under these parameters, the factor of safety against global failure of the slope was determined to be greater than typical industry targeted standard of 1.3.

It should be understood that stability of the soil slopes and foundation geometries were modeled under the conditions outlined herein. Changes in building location or geometry, grading, erosion and other natural events can impact the global stability. We should be retained to perform additional analyses and consulting as the final plans are developed.

Finally, we note that in general, any permanent cuts or embankment fills should be sloped no steeper than one vertical on two horizontal (1V:2H). Filled slopes must be constructed of import Structural Fill. All slopes should be vegetated and protected against erosion.

## GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements and design are the responsibility of others. If changes in the nature, design, or location of the project

are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

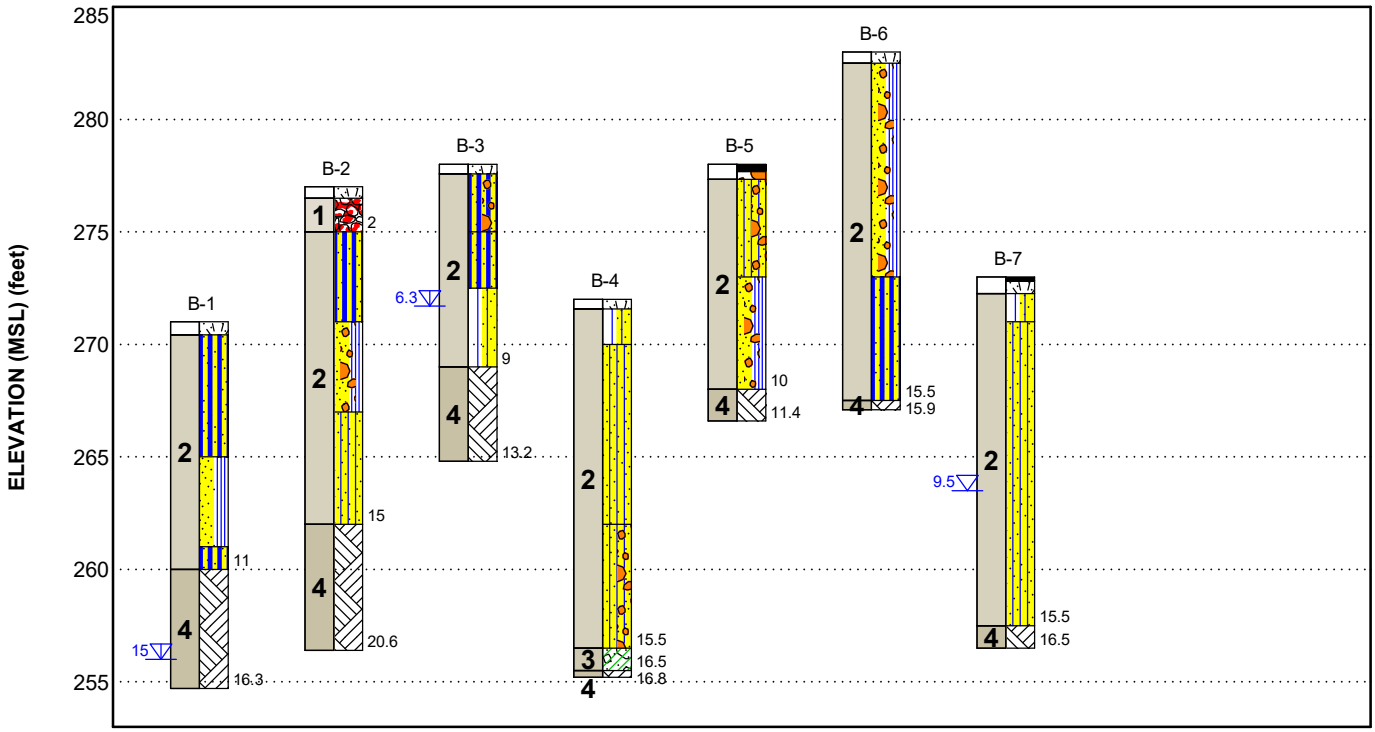
# FIGURES

**Contents:**

GeoModel (2 pages)

## GEOMODEL

**New DPW Facility ■ Ardsley, New York**
**Terracon Project No. JB205051**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | **Fill Material** | Typically silts and sands with lesser amounts of foreign matter (e.g., fragments of brick, concrete, asphalt, coal, etc.) |
| 2 | **Native sand and silt** | Varying proportions of sand and silt with lesser amounts of gravel |
| 3 | **Glacial Till** | Typically silt and fine sand with embedded coarser sands, gravel |
| 4 | **Bedrock** | Schist, weathered and decomposed |

## LEGEND

- Topsoil
- Bedrock
- Silty Sand
- Silty Sand with Gravel
- Poorly-graded Gravel
- Sandy Silt
- Fill
- Sandy Silt with Gravel
- Glacial Till
- Poorly-graded Sand with Silt
- Poorly-graded Sand with Silt and Gravel
- Silt with Sand
- Asphalt

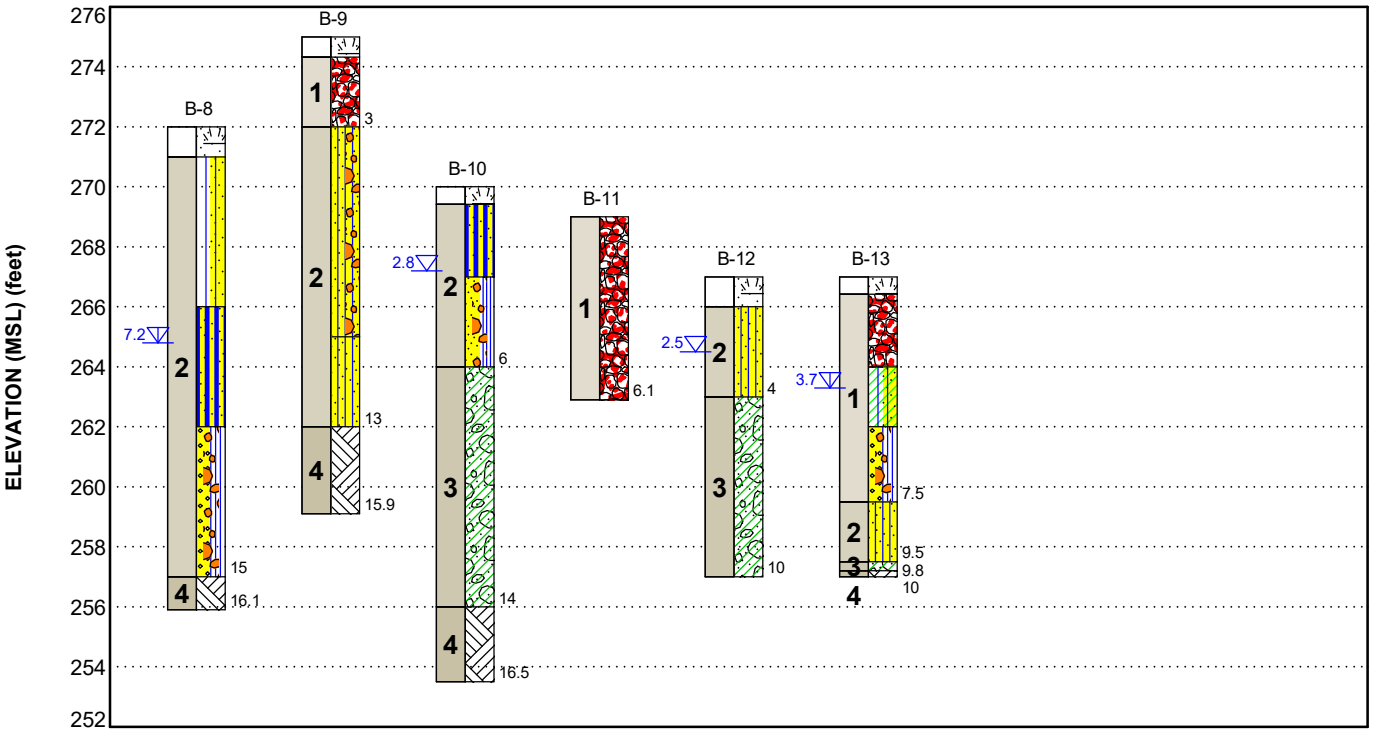
First Water Observation
Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

## GEOMODEL

**New DPW Facility ■ Ardsley, New York**
**Terracon Project No. JB205051**

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| 4 | **Bedrock** | Schist, weathered and decomposed |

## LEGEND

- Topsoil
- Silt with Sand
- Sandy Silt
- Well-graded Sand with Silt and Gravel
- Bedrock
- Fill
- Silty Sand with Gravel
- Silty Sand
- Poorly-graded Sand with Silt and Gravel
- Glacial Till
- Silty Clay with Sand

First Water Observation
Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

# ATTACHMENTS

# EXPLORATION AND TESTING PROCEDURES

## Field Exploration

| Boring No. | Boring Depth (feet) | Location |
|---|---|---|
| B-1 thru B-10 | 11.4 to 20.6 | Proposed building footprints |
| B-11 thru B-13 | 6.1 to 10.0 | Pavement/wall areas |

**Test Boring Layout and Elevations:** The test boring locations were established in the field by Terracon using a hand-held GPS unit, taped measurements and/or visual reference from existing site features. The boreholes were located on the basis of the proposed building and parking layout provided to us, within the limitations of access, existing structures and utilities. Proposed test boring B-14 (north of the site) was deleted due to reconfiguration of access road plans.

Ground surface elevation at each borehole location was estimated based upon our interpolation between topographic contours shown on the site plans provided to us. If more precise locations and/or elevations are desired, the as-drilled boring locations should be surveyed.

**Test Boring Subsurface Exploration Procedures:** The test borings were made using a standard rotary drill rig equipped with hollow stem augers. As the augers were advanced, the soils were sampled at intervals of five feet or less in accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils, ASTM D1586. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling 30-inches. The number of blows required to advance the sampling spoon the middle 12-inches of a normal 24-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the corresponding test depths. Upon completion of drilling the boreholes were backfilled with auger cuttings and/or sand, with the surface restored in kind in pavement areas.

Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs.

The soil samples were placed in appropriate containers and taken to our soils laboratory for classification by a Geotechnical Engineer. Final individual boring logs were prepared, and they represent the Geotechnical Engineer's interpretation of the field logs and include modifications as appropriate based on observations and/or testing of the samples in our laboratory.

## Laboratory Testing

Selected recovered samples from the test borings were submitted for laboratory testing as part of the subsurface investigation, to confirm the visual classifications and to provide quantitative index properties for use in the geotechnical evaluation. This testing was performed in general accordance with the following standard methods:

- ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil - and Rock by Mass (5 samples tested)

- ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils (w/o hydrometer) (5 samples tested)

# SITE LOCATION AND EXPLORATION PLANS

**Contents:**

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above

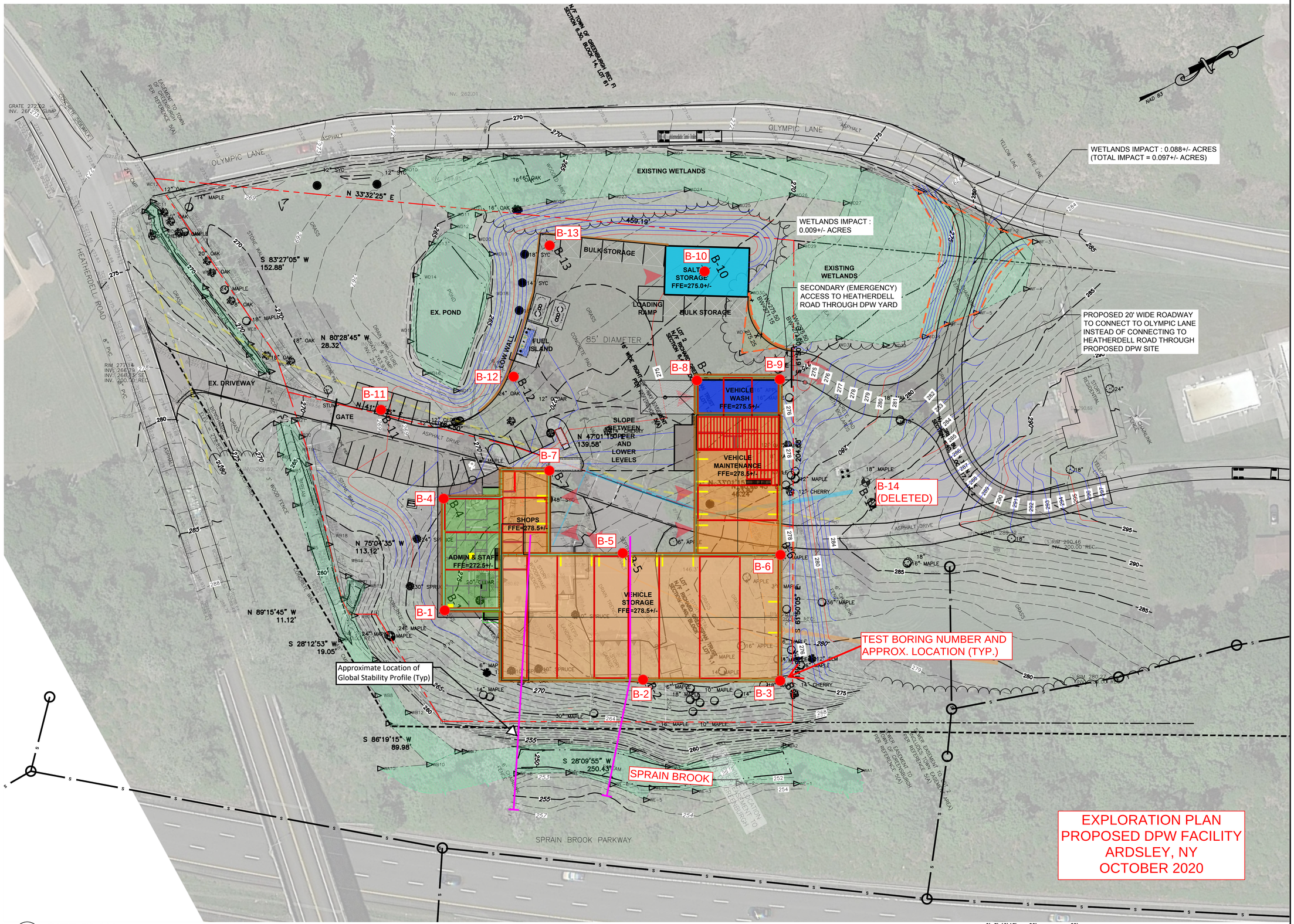
## SITE LOCATION

New DPW Facility ■ Ardsley, NY

October 2020 ■ Terracon Project No. JB205051

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: WHITE PLAINS, NY (1/1/1994) and MOUNT VERNON, NY (1/1/1995).




1 **SITE PLAN**
SCALE:BAR SCALE

0' 5' 10' 15' 30' 60'
SCALE: 1" = 30'-0"

Unauthorized alteration or addition to this document is a violation of Section 7209. Subdivision 2 of the New York State Education Law.

**Project:**

VILLAGE OF ARDSLEY, NY

NEW PUBLIC WORKS FACILITY
220 HEATHERDELL ROAD
ARDSLEY, NY 10502

Weston & Sampson
Weston & Sampson Engineers, Inc.
100 Foxborough Boulevard, Suite 250
Foxborough, MA 02035
(508) 698-3034 (800) SAMPSON
www.westonandsampson.com

Consultants:

ZONE R-1 SETBACKS
EX. WETLAND EDGE
25' WETLAND BUFFER
EX. WATER PIPE
EX. SANITARY SEWER
EX. ELECTRIC (OHW)

Seal:

Revisions:

| Rev | Date | Description |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

PROGRESS PRINT
8-20-2020
NOT FOR CONSTRUCTION

Issued For: ----

**Conceptual Siteplan**

0' 5' 10' 15' 30' 60'
SCALE: 1" = 30'-0"

Date: JUNE 2, 2020
Drawn By:
Reviewed By:
Approved By:
W&S Project No: N2190088

Drawing Title:

SITE LAYOUT PLAN

Sheet Number:

C100

WESTON & SAMPSON COPYRIGHT 2020

# EXPLORATION RESULTS

**Contents:**

Test Boring Logs (13 pages)
Infiltration Test Results (2 pages)
Laboratory Test Results

Note: All attachments are one page unless noted above

# BORING LOG NO. B-1



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0178° Longitude: -73.8255°

Approximate Surface Elev.: 271 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | DESCRIPTION | SAMPLE TYPE | FIELD TEST RESULTS |
|---|---|---|---|---|---|
| | 0.6 | 270.5+/- | **TOPSOIL** | | |
| 2 | 6.0 | 265+/- | **SANDY SILT (ML)**, trace gravel, fine to medium grained, brown, moist, soft | | 1-1-2-2 N=3; 1-1-2-6 N=3 |
| | 10.0 | 261+/- | **POORLY GRADED SAND WITH SILT (SP-SM)**, with silty seams, trace gravel, brown, moist, medium dense | | 6-9-12-12 N=21 |
| | 11.0 | 260+/- | **SANDY SILT (ML)**, brown, moist, very stiff | | 9-11-14 N=25 |
| 4 | 16.3 | 254.5+/- | **DECOMPOSED SCHIST**, brown to gray, moist, medium dense to very dense | | 27-37-50/4" |
| | | | ***Sampler Refusal on Bedrock at 16.3 Feet*** | | |

DEPTH (Ft.): 5, 10, 15

WATER LEVEL OBSERVATIONS

WATER CONTENT (%)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered while drilling*

*15 feet 24 hours after boring completion*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-15-2020 | Boring Completed: 07-15-2020

Drill Rig: CME 55 | Driller: J. Lamm

Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-2



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0182° Longitude: -73.8252°

Approximate Surface Elev.: 277 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | | SAMPLE TYPE | FIELD TEST RESULTS |
|---|---|---|---|---|---|
| | 0.5 | 276.5+/- | **TOPSOIL** | | |
| 1 | 2.0 | 275+/- | **FILL - SILT WITH SAND (ML)**, trace coal, brown, moist, medium stiff | | 1-2-2-2 N=4 |
| 2 | 6.0 | 271+/- | **SANDY SILT WITH GRAVEL (ML)**, orange to brown, moist, stiff<br>Silt Seams noted | | 3-6-8-14 N=14 |
| 2 | 10.0 | 267+/- | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, brown, moist, dense | | 4-13-20-10 N=33 |
| 2 | 15.0 | 262+/- | **SILTY SAND (SM)**, with silt seams, brown, moist, medium dense | | 6-9-20-24 N=29 |
| 4 | 20.6 | 256.5+/- | **DECOMPOSED SCHIST**, moist, very dense | | 50/4"<br>40-50/1" |
| | | | ***Sampler Refusal on Bedrock at 20.6 Feet*** | | |

DEPTH (Ft.): 5, 10, 15, 20

WATER LEVEL OBSERVATIONS

WATER CONTENT (%)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered while drilling*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-15-2020
Boring Completed: 07-15-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-3



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0184° Longitude: -73.825°

Approximate Surface Elev.: 278 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | DESCRIPTION | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|
| 2 | 0.4 | 277.5+/- | **TOPSOIL** | | |
| | | | **SANDY SILT WITH GRAVEL (ML)**, brown, moist, stiff | 1-2-3-7 N=5 | |
| | 3.0 | 275+/- | **SANDY SILT (ML)**, brown, moist, stiff to very stiff | 10-7-8-8 N=15 | |
| | 5.5 | 272.5+/- | **SILT WITH SAND (ML)**, mottled, brown to gray, moist, very stiff | 16-9-12-12 N=21 | 20.3 |
| 4 | 9.0 | 269+/- | **WEATHERED SCHIST**, gray to white, moist, very dense | 50/4" | |
| | 13.2 | 265+/- | ***Sampler Refusal on Bedrock at 13.2 Feet*** | 50/2" | |

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: 6.3 feet after boring completion

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*6.3 feet after boring completion*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-16-2020
Boring Completed: 07-16-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-4



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0179° Longitude: -73.8257°

Approximate Surface Elev.: 272 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|---|
| | 0.4 | 271.5+/- | **TOPSOIL** | | | |
| 2 | | | **SILT WITH SAND (ML)**, brown, moist, medium stiff | | 1-2-2-5 N=4 | |
| | 2.0 | 270+/- | **SILTY SAND (SM)**, with gravel seams, brown, moist, medium dense to dense | | 5-6-11-20 N=17 | 11.7 |
| | | | Pockets of Weathered Schist | | 11-15-32-35 N=47 | |
| | 10.0 | 262+/- | **SILTY SAND WITH GRAVEL (SM)**, brown, moist, medium dense | | 10-10-12 N=22 | |
| | 15.5 | 256.5+/- | | | | |
| 3 | | | **SANDY SILT (ML)**, trace gravel, gray, moist, very stiff, (GLACIAL TILL) | | 6-4-14-50/4" N=18 | |
| | 16.5 | 255.5+/- | | | | |
| 4 | 16.8 | 255+/- | **WEATHERED SCHIST**, black to white, moist, very dense | | | |
| | | | ***Sampler Refusal on Probable Bedrock at 16.8 Feet*** | | | |

DEPTH (Ft.): 5, 10, 15

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-16-2020
Boring Completed: 07-16-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-5



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0182° Longitude: -73.8254°

Approximate Surface Elev.: 278 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | 0.3 **ASPHALT** | 277.5+/- | | | | | |
| | | 0.7 **CRUSHED STONE** | 277.5+/- | | | | | |
| 2 | | **SILTY SAND WITH GRAVEL (SM)**, mottled, brown, moist, medium dense to dense | | | | X | 6-4-7-11 N=11 | |
| | | | | | | X | 3-7-30-30 N=37 | |
| | | 5.0 | 273+/- | 5 | | | | |
| | | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, silt lenses, brown, moist, medium dense | | | | X | 18-13-16-13 N=29 | |
| | | 10.0 | 268+/- | 10 | | | | |
| 4 | | **WEATHERED SCHIST**, brown/black, moist, very dense | | | | X | 30-45-50/5" | |
| | | 11.4 | 266.5+/- | | | | | |
| | | ***Sampler Refusal on Bedrock at 11.4 Feet*** | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-16-2020 | Boring Completed: 07-16-2020

Drill Rig: CME 55 | Driller: J. Lamm

Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-6



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0185° Longitude: -73.8253°

Approximate Surface Elev.: 283 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | | DEPTH (Ft.) | SAMPLE TYPE | FIELD TEST RESULTS |
|---|---|---|---|---|---|---|
| 2 | 0.5 | 282.5+/- | **TOPSOIL** | | | |
| | | | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, brown, moist, medium dense to very dense | | | 1-4-7-8 N=11 |
| | | | Fine Sand Lenses noted | | | 5-12-14-14 N=26 |
| | | | Cobbles noted | 5 | | 15-33-42-23 N=75 |
| | 10.0 | 273+/- | | | | |
| | | | **SANDY SILT (ML)**, trace gravel, brown to gray, moist, very stiff | 10 | | 8-8-11 N=19 |
| | 15.5 | 267.5+/- | | 15 | | 31-50/5" |
| 4 | 15.9 | 267+/- | **WEATHERED SCHIST**, brown, moist, very dense | | | |
| | | | ***Sampler Refusal on Probable Bedrock at 15.9 Feet*** | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-16-2020 | Boring Completed: 07-16-2020

Drill Rig: CME 55 | Driller: J. Lamm

Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-7



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0182° Longitude: -73.8257°

Approximate Surface Elev.: 273 (Ft.) +/-

| DEPTH | ELEVATION (Ft.) | MODEL LAYER | DESCRIPTION | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|
| 0.2 | 273+/- | | **ASPHALT** | | |
| 0.8 | 272.5+/- | | **TOPSOIL** | | |
| 2.0 | 271+/- | 2 | **SILT WITH SAND (ML)**, dark brown to brown, moist, medium stiff | 2-2-2-2 N=4 | |
| | | 2 | **SILTY SAND (SM)**, trace gravel, mottled, brown to gray, medium dense to dense | 5-7-42-50/2" N=49 | |
| | | 2 | | 10-10-14-23 N=24 | 11.2 |
| | | 2 | Grades Brown, Gravelly (WET) | 3-6-11 N=17 | |
| 15.5 | 257.5+/- | 4 | **WEATHERED SCHIST**, black to white, moist, very dense | 7-23-46 N=69 | |
| 16.5 | 256.5+/- | | ***Sampler Refusal on Probable Bedrock at 16.5 Feet*** | | |

DEPTH (Ft.): 5, 10, 15

WATER LEVEL OBSERVATIONS: ▽ 9.5' after 5' - 7' sample

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *9.5' after 5' - 7' sample*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-16-2020
Boring Completed: 07-16-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-8



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0185° Longitude: -73.8257°

Approximate Surface Elev.: 272 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | DESCRIPTION | SAMPLE TYPE | FIELD TEST RESULTS |
|---|---|---|---|---|---|
| | 1.0 | 271+/- | **TOPSOIL** | | |
| 2 | | | **SILT WITH SAND (ML)**, dark brown to brown, moist, medium stiff to stiff<br>Grades trace gravel | | 1-2-2-2<br>N=4<br>3-3-7-8<br>N=10 |
| | 6.0 | 266+/- | **SANDY SILT (ML)**, with gravel seams, brown, moist, very stiff | | 6-9-6-7<br>N=15 |
| | 10.0 | 262+/- | **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, brown to gray, moist, dense | | 10-14-16<br>N=30 |
| | 15.0 | 257+/- | | | |
| 4 | 16.1 | 256+/- | **WEATHERED SCHIST**, white/gray, wet, very dense | | 16-48-50/1" |
| | | | ***Sampler Refusal on Probable Bedrock at 16.1 Feet*** | | |

DEPTH (Ft.): 5, 10, 15

WATER LEVEL OBSERVATIONS: ▽

WATER CONTENT (%)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *7.2' after boring completion*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-15-2020
Boring Completed: 07-15-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-9



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0187° Longitude: -73.8256°

Approximate Surface Elev.: 275 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | DESCRIPTION | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|---|
| | 0.7 | 274.5+/- | **TOPSOIL** | | | |
| 1 | 3.0 | 272+/- | **FILL - SANDY SILT (ML)**, trace gravel, brown, moist, medium stiff, trace brick | | 1-2-3-3 N=5 | |
| | | | | | 7-29-50/5" | |
| 2 | 10.0 | 265+/- | **SILTY SAND WITH GRAVEL (SM)**, brown, moist, very dense to medium dense<br>Cobble noted | | 8-14-13-17 N=27 | 11.4 |
| | 13.0 | 262+/- | **SILTY SAND (SM)**, gray, medium dense | | 3-10-17 N=27 | |
| 4 | 15.9 | 259+/- | **WEATHERED SCHIST**, brown to gray, moist | | 44-50/5" | |
| | | | ***Sampler Refusal on Bedrock at 15.9 Feet*** | | | |

DEPTH (Ft.): 5, 10, 15

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-14-2020
Boring Completed: 07-14-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-10



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0186° Longitude: -73.8259°

Approximate Surface Elev.: 270 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | DESCRIPTION | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|
| | 0.6 | 269.5+/- | **TOPSOIL** | | |
| 2 | 3.0 | 267+/- | **SANDY SILT (ML)**, brown, moist, medium stiff | 1-2-2-1 N=4 | |
| | | | | 4-7-13-17 N=20 | |
| 2 | 6.0 | 264+/- | **POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, brown, moist, medium dense | 7-8-6-8 N=14 | |
| 3 | 14.0 | 256+/- | **SILTY SAND (SM)**, brown, wet, medium dense to dense, (GLACIAL TILL) | 2-13-19 N=32 | 13.6 |
| 4 | 16.5 | 253.5+/- | **DECOMPOSED SCHIST**, gray, moist, medium dense | 6-10-15 N=25 | |
| | | | ***Auger Refusal on Bedrock at 16.5 Feet*** | | |

DEPTH (Ft.): 5, 10, 15

WATER LEVEL OBSERVATIONS: ▽

SAMPLE TYPE: ☒

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *2.8' after 5' - 7' sample*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-15-2020 | Boring Completed: 07-15-2020

Drill Rig: CME 55 | Driller: J. Lamm

Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-11



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0179° Longitude: -73.8261°

Approximate Surface Elev.: 269 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | | **FILL - SILTY SAND (SM)**, brown/gray, moist, dense to very dense, with Concrete, Asphalt, and Brick, cobbles noted | | | | | 2-5-29-9 N=34 | |
| | | Grades Sandy SILT and CONCRETE, Dark Brown to Gray | | | | | 15-21-50/4" | |
| | | | | 5 | | | 50/5" | |
| | | 6.1 | 263+/- | | | | 70-50/1" | |
| | | ***Sampler Refusal at 6.1 Feet*** | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-15-2020
Boring Completed: 07-15-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-12



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0182° Longitude: -73.826°

Approximate Surface Elev.: 267 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | **TOPSOIL** 1.0 | 266+/- | | | | | |
| 2 | | **SILTY SAND (SM)**, trace gravel, brown to brown mottled, wet, loose to medium dense | | | | | 1-2-2-2 N=4 | |
| | | Grades Mottled | | | ▽ | | 4-6-7-7 N=13 | |
| | | 4.0 | 263+/- | | | | | |
| 3 | | **SANDY SILT WITH GRAVEL (ML)**, pockets of decomposed Schist, gray, moist to wet, stiff, (GLACIAL TILL) | | 5 | | | 7-6-9-12 N=15 | |
| | | | | | | | 8-8-7-7 N=15 | |
| | | Grades Brown | | | | | 8-6-6-7 N=12 | |
| | | 10.0 | 257+/- | 10 | | | | |
| | | ***Boring Terminated at 10 Feet*** | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

▽ *2.5' after 2' - 4' sample*

Terracon
30 Corporate Cir Ste 201
Albany, NY

| | |
|---|---|
| Boring Started: 07-14-2020 | Boring Completed: 07-14-2020 |
| Drill Rig: CME 55 | Driller: J. Lamm |
| Project No.: JB205051 | |

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# BORING LOG NO. B-13



**PROJECT:** New DPW Facility

**CLIENT:** Weston & Sampson, Inc.
Albany, New York

**SITE:** Heatherdell Rd.
Ardsley, New York

LOCATION See Exploration Plan

Latitude: 41.0183° Longitude: -73.8262°

Approximate Surface Elev.: 267 (Ft.) +/-

| MODEL LAYER | DEPTH | ELEVATION (Ft.) | DESCRIPTION | SAMPLE TYPE | FIELD TEST RESULTS |
|---|---|---|---|---|---|
| | 0.6 | 266.5+/- | **TOPSOIL** | | |
| 1 | 3.0 | 264+/- | **FILL - SANDY SILT (ML)**, brown to gray, moist to wet, soft, trace gravel and brick | | 1-2-1-4 N=3 |
| 1 | 5.0 | 262+/- | **SILTY CLAY WITH SAND (CL-ML)**, mottled, brown to gray, moist, medium stiff, (possible fill) | | 4-3-2-2 N=5 |
| 1 | 7.5 | 259.5+/- | **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, mottled, brown to gray, wet, loose to medium dense, (possible fill) | | 1-2-6-9 N=8 |
| 2 | 9.5 | 257.5+/- | **SILTY SAND (SM)**, brown, moist, medium dense to dense | | 13-14-13-17 N=27 |
| 3 | 9.8 | 257+/- | **SANDY SILT (ML)**, trace gravel, gray, moist, very stiff | | 10-13-17-30 N=30 |
| 4 | 10.0 | 257+/- | **WEATHERED SCHIST** | | |

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: 3.7' after boring completion

WATER CONTENT (%)

***Boring Terminated at 10 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*3.7' after boring completion*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 07-14-2020
Boring Completed: 07-14-2020
Drill Rig: CME 55
Driller: J. Lamm
Project No.: JB205051

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 10/1/20

# INFILTRATION TEST RESULTS

| | |
|---|---|
| **PROJECT:** New DPW Facility | **PROJECT NO.** JB205051 |
| **PROJECT LOCATION:** Ardsley, New York | **TEST DATE:** 7/16/2020 |
| **WEATHER:** | **TESTER:** J. Lamm |

| Test Location | Test Depth (feet) | Trial No. | Water Drop (in) | Elapsed Time (min) | Infiltration Rate (inches/hour) |
|---|---|---|---|---|---|
| I-8 | 4.0 | 1 | 0.0 | 60 | 0.0 |
| | | 2 | 0.0 | 60 | 0.0 |
| | | 3 | 0.0 | 60 | 0.0 |
| | | 4 | 0.0 | 60 | 0.0 |
| | | Infiltration rate for trial no. 4 = 0 inches per hour<br>Average infiltration rate for trials no. 1-4 = 0 inches per hour | | | |
| I-11 | 4.0 | 1 | 12.0 | 60 | 12.0 |
| | | 2 | 7.5 | 60 | 7.5 |
| | | 3 | 6.8 | 60 | 6.8 |
| | | 4 | 4.8 | 60 | 4.8 |
| | | Infiltration rate for trial no. 4 = 4.8 inches per hour<br>Average infiltration rate for trials no. 1-4 = 7.8 inches per hour | | | |

Notes:

(1) Testing was conducted in general accord with the "Infiltration Testing Requirements" outlined in Appendix D of the New York State Stormwater Management Design Manual.

(2) Infiltration tests were located alongside companion test borings with "B" prefix and numbered correspondingly.

**SOIL CLASSIFICATION AT TEST DEPTH**

Test Location I-8: SILT with Sand, trace gravel

Test Location I-11: FILL: Sandy SILT and CONCRETE

| INFILTRATION TEST RESULTS | | | | | |
|---|---|---|---|---|---|
| **PROJECT:** New DPW Facility | | | | **PROJECT NO.** JB205051 | |
| **PROJECT LOCATION:** Ardsley, New York | | | | **TEST DATE:** 7/16/2020 | |
| **WEATHER:** | | | | **TESTER:** J. Lamm | |
| **Test Location** | **Test Depth (feet)** | **Trial No.** | **Water Drop (in)** | **Elapsed Time (min)** | **Infiltration Rate (inches/hour)** |
| I-12 | 1.5 | 1 | 10.0 | 60 | 10.0 |
| | | 2 | 10.0 | 60 | 10.0 |
| | | 3 | 9.5 | 60 | 9.5 |
| | | 4 | 9.3 | 60 | 9.3 |
| | | Infiltration rate for trial no. 4 = 9.3 inches per hour<br>Average infiltration rate for trials no. 1-4 = 9.7 inches per hour | | | |
| I-13 | 2.5 | 1 | 0.0 | 60 | 0.0 |
| | | 2 | 0.0 | 60 | 0.0 |
| | | 3 | 0.5 | 60 | 0.5 |
| | | 4 | 0.8 | 60 | 0.8 |
| | | Infiltration rate for trial no. 4 = 0.8 inches per hour<br>Average infiltration rate for trials no. 1-4 = 0.3 inches per hour | | | |

Notes:

(3) Testing was conducted in general accord with the “Infiltration Testing Requirements” outlined in Appendix D of the New York State Stormwater Management Design Manual.

(4) Infiltration tests were located alongside companion test borings with “B” prefix and numbered correspondingly.

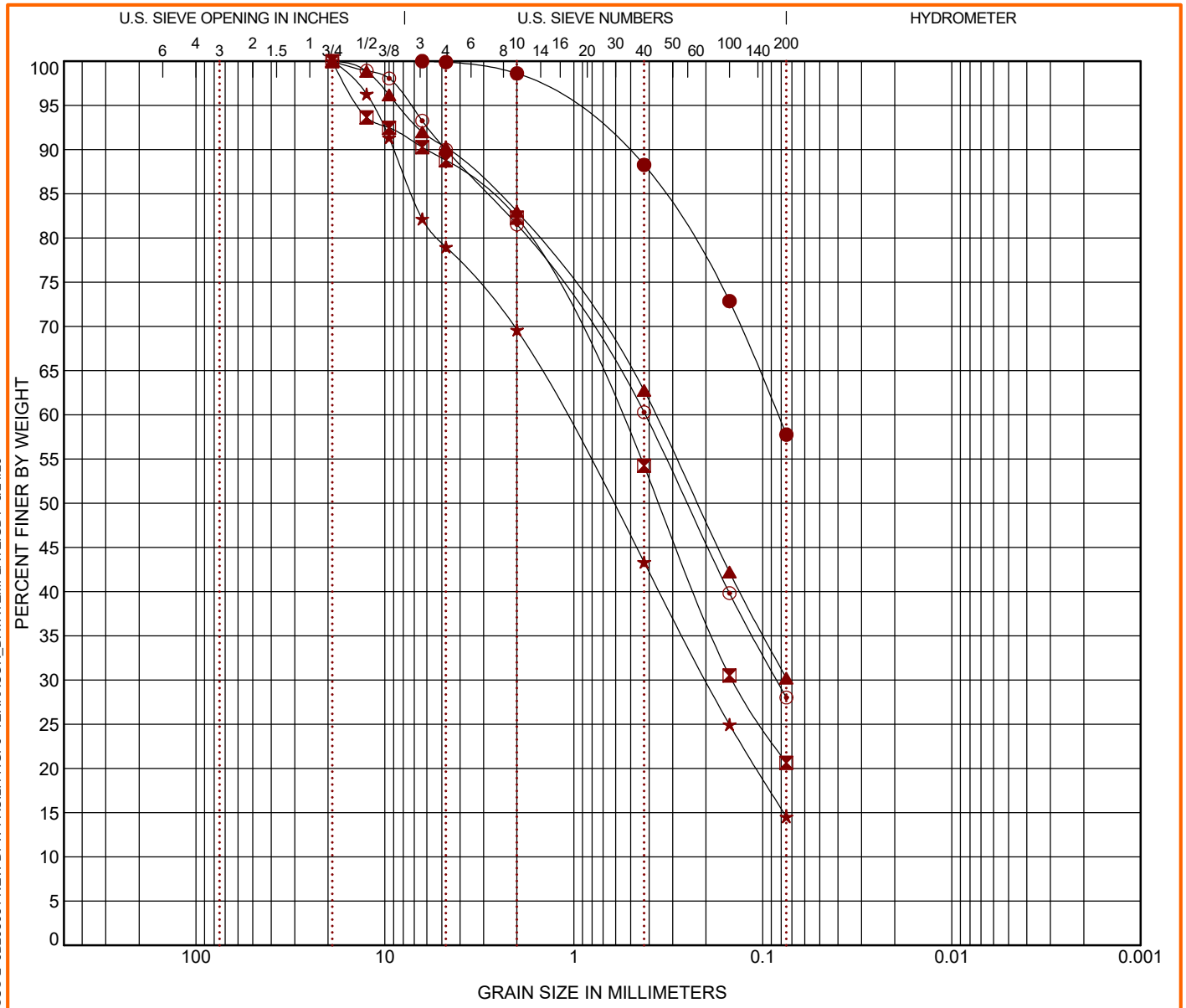
**SOIL CLASSIFICATION AT TEST DEPTH**

Test Location I-12: Silty SAND, trace gravel

Test Location I-13: FILL: Sandy SILT

# GRAIN SIZE DISTRIBUTION

**ASTM D422 / ASTM C136**




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Boring ID | Depth | USCS Classification | WC (%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | B-3 | 4 - 6 | SANDY SILT (ML) | 20.3 | | | | | |
| ⊠ | B-4 | 2 - 4 | SILTY SAND (SM) | 11.7 | | | | | |
| ▲ | B-7 | 5 - 7 | SILTY SAND (SM) | 11.2 | | | | | |
| ★ | B-9 | 5 - 7 | SILTY SAND with GRAVEL (SM) | 11.4 | | | | | |
| ⊙ | B-10 | 10 - 11.5 | SILTY SAND (SM) | 13.6 | | | | | |

| | Boring ID | Depth | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Silt | %Fines | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-3 | 4 - 6 | 6.35 | 0.083 | | | 0.0 | 0.1 | 42.1 | | 57.8 | |
| ⊠ | B-4 | 2 - 4 | 19 | 0.584 | 0.145 | | 0.0 | 11.2 | 68.2 | | 20.6 | |
| ▲ | B-7 | 5 - 7 | 19 | 0.37 | | | 0.0 | 9.8 | 60.0 | | 30.2 | |
| ★ | B-9 | 5 - 7 | 19 | 1.135 | 0.2 | | 0.0 | 21.0 | 64.5 | | 14.5 | |
| ⊙ | B-10 | 10 - 11.5 | 19 | 0.419 | 0.084 | | 0.0 | 10.0 | 62.0 | | 28.0 | |

PROJECT: New DPW Facility

SITE: Heatherdell Rd.
Ardsley, New York

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB205051

CLIENT: Weston & Sampson Engineers, Inc.
Albany, New York

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB205051 NEW DPW FACILITY.GPJ TERRACON_DATATEMPLATE.GDT 8/24/20

# SUPPORTING INFORMATION

**Contents:**

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above

# GENERAL NOTES

**DESCRIPTION OF SYMBOLS AND ABBREVIATIONS**
**New DPW Facility ■ Ardsley, New York**
**Terracon Project No. JB205051**

| SAMPLING | WATER LEVEL | FIELD TESTS | |
|---|---|---|---|
| Split Spoon | **Water Initially Encountered**<br>**Water Level After a Specified Period of Time**<br>**Water Level After a Specified Period of Time**<br>**Cave In Encountered**<br><br>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations. | **N** | **Standard Penetration Test Resistance (Blows/Ft.)** |
| | | **(HP)** | **Hand Penetrometer** |
| | | **(T)** | **Torvane** |
| | | **(DCP)** | **Dynamic Cone Penetrometer** |
| | | **UC** | **Unconfined Compressive Strength** |
| | | **(PID)** | **Photo-Ionization Detector** |
| | | **(OVA)** | **Organic Vapor Analyzer** |

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

## LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

## STRENGTH TERMS

| RELATIVE DENSITY OF COARSE-GRAINED SOILS<br>(More than 50% retained on No. 200 sieve.)<br>Density determined by Standard Penetration Resistance | | CONSISTENCY OF FINE-GRAINED SOILS<br>(50% or more passing the No. 200 sieve.)<br>Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance | | |
|---|---|---|---|---|
| **Descriptive Term (Density)** | **Standard Penetration or N-Value Blows/Ft.** | **Descriptive Term (Consistency)** | **Unconfined Compressive Strength Qu, (tsf)** | **Standard Penetration or N-Value Blows/Ft.** |
| Very Loose | 0 - 3 | Very Soft | less than 0.25 | 0 - 1 |
| Loose | 4 - 9 | Soft | 0.25 to 0.50 | 2 - 4 |
| Medium Dense | 10 - 29 | Medium Stiff | 0.50 to 1.00 | 4 - 8 |
| Dense | 30 - 50 | Stiff | 1.00 to 2.00 | 8 - 15 |
| Very Dense | > 50 | Very Stiff | 2.00 to 4.00 | 15 - 30 |
| | | Hard | > 4.00 | > 30 |

## RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

# UNIFIED SOIL CLASSIFICATION SYSTEM

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A] | | | | | Soil Classification | |
|---|---|---|---|---|---|---|
| | | | | | Group Symbol | Group Name [B] |
| **Coarse-Grained Soils:** More than 50% retained on No. 200 sieve | **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve | **Clean Gravels:** Less than 5% fines [C] | Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E] | | GW | Well-graded gravel [F] |
| | | | Cu < 4 and/or [Cc<1 or Cc>3.0] [E] | | GP | Poorly graded gravel [F] |
| | | **Gravels with Fines:** More than 12% fines [C] | Fines classify as ML or MH | | GM | Silty gravel [F, G, H] |
| | | | Fines classify as CL or CH | | GC | Clayey gravel [F, G, H] |
| | **Sands:** 50% or more of coarse fraction passes No. 4 sieve | **Clean Sands:** Less than 5% fines [D] | Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E] | | SW | Well-graded sand [I] |
| | | | Cu < 6 and/or [Cc<1 or Cc>3.0] [E] | | SP | Poorly graded sand [I] |
| | | **Sands with Fines:** More than 12% fines [D] | Fines classify as ML or MH | | SM | Silty sand [G, H, I] |
| | | | Fines classify as CL or CH | | SC | Clayey sand [G, H, I] |
| **Fine-Grained Soils:** 50% or more passes the No. 200 sieve | **Silts and Clays:** Liquid limit less than 50 | **Inorganic:** | PI > 7 and plots on or above "A" | | CL | Lean clay [K, L, M] |
| | | | PI < 4 or plots below "A" line [J] | | ML | Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried / Liquid limit - not dried | < 0.75 | OL | Organic clay [K, L, M, N] |
| | | | | | | Organic silt [K, L, M, O] |
| | **Silts and Clays:** Liquid limit 50 or more | **Inorganic:** | PI plots on or above "A" line | | CH | Fat clay [K, L, M] |
| | | | PI plots below "A" line | | MH | Elastic Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried / Liquid limit - not dried | < 0.75 | OH | Organic clay [K, L, M, P] |
| | | | | | | Organic silt [K, L, M, Q] |
| **Highly organic soils:** | Primarily organic matter, dark in color, and organic odor | | | | PT | Peat |

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

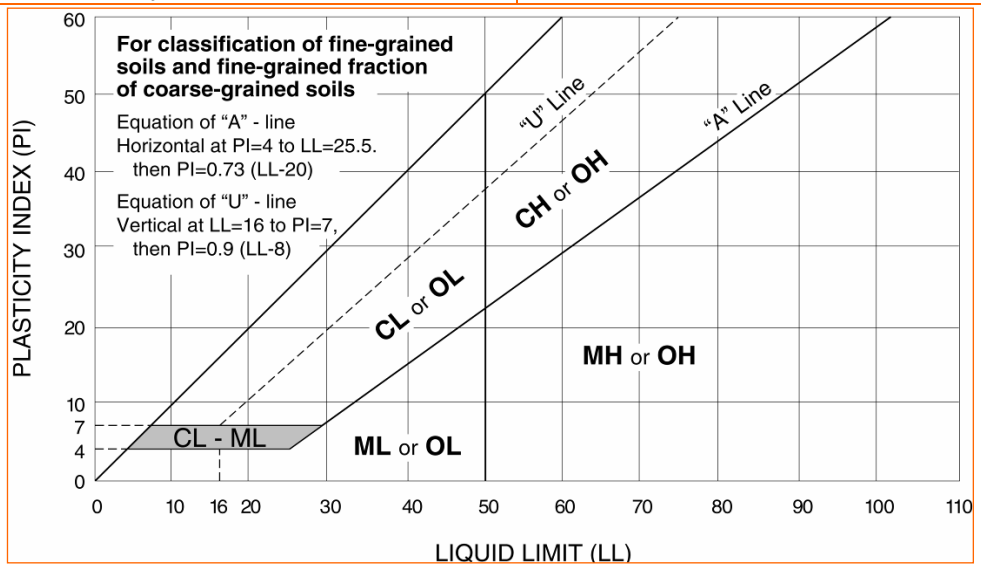
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



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VACUUM EXCAVATION DATA SHEET
ENGLISH UNITS

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www.softdig.com
softdig@softdig.com

SoftDig Project #: 107890-1 Test Hole #: 1 Client: Weston & Sampson Date: 3/16/21

One-Call Permit: N/A Crew: R. Johnson, J. Andrews Truck #: S-144

City / County / State: Ardsley Westchester County NY Road: Olympic Lane

General Location: near building number 220 Anticipated Utility: Water

## TEST HOLE INFORMATION

Utility Description: 4" Black Metal Water Pipe

Utility Owner: Greensburgh Twp Marker Paint: Blue

Surface Elevation at Survey Mark: 84.67' Wood Hub

Utility Top Elevation: 81.97'

Utility Bottom Elevation: N/A

Width (For Duct Bank): N/A Type: N/A

Utility Top Depth From Surface: 2.70'

Utility Bottom Depth From Surface: N/A

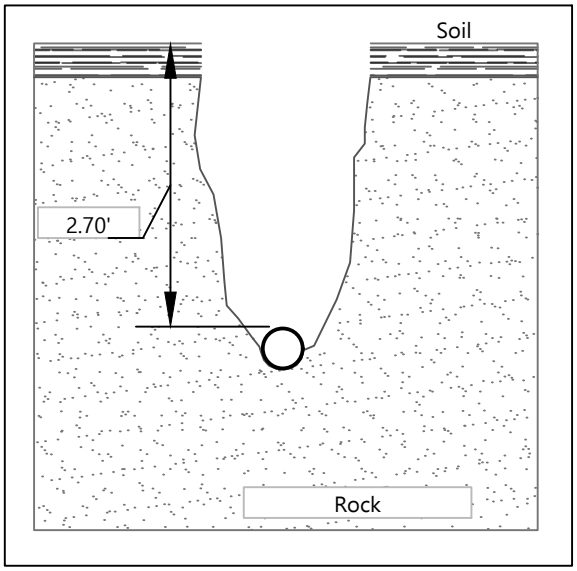
Benchmark Elevation: 100.00' Type: Assumed

Description: Sanitary Sewer Manhole

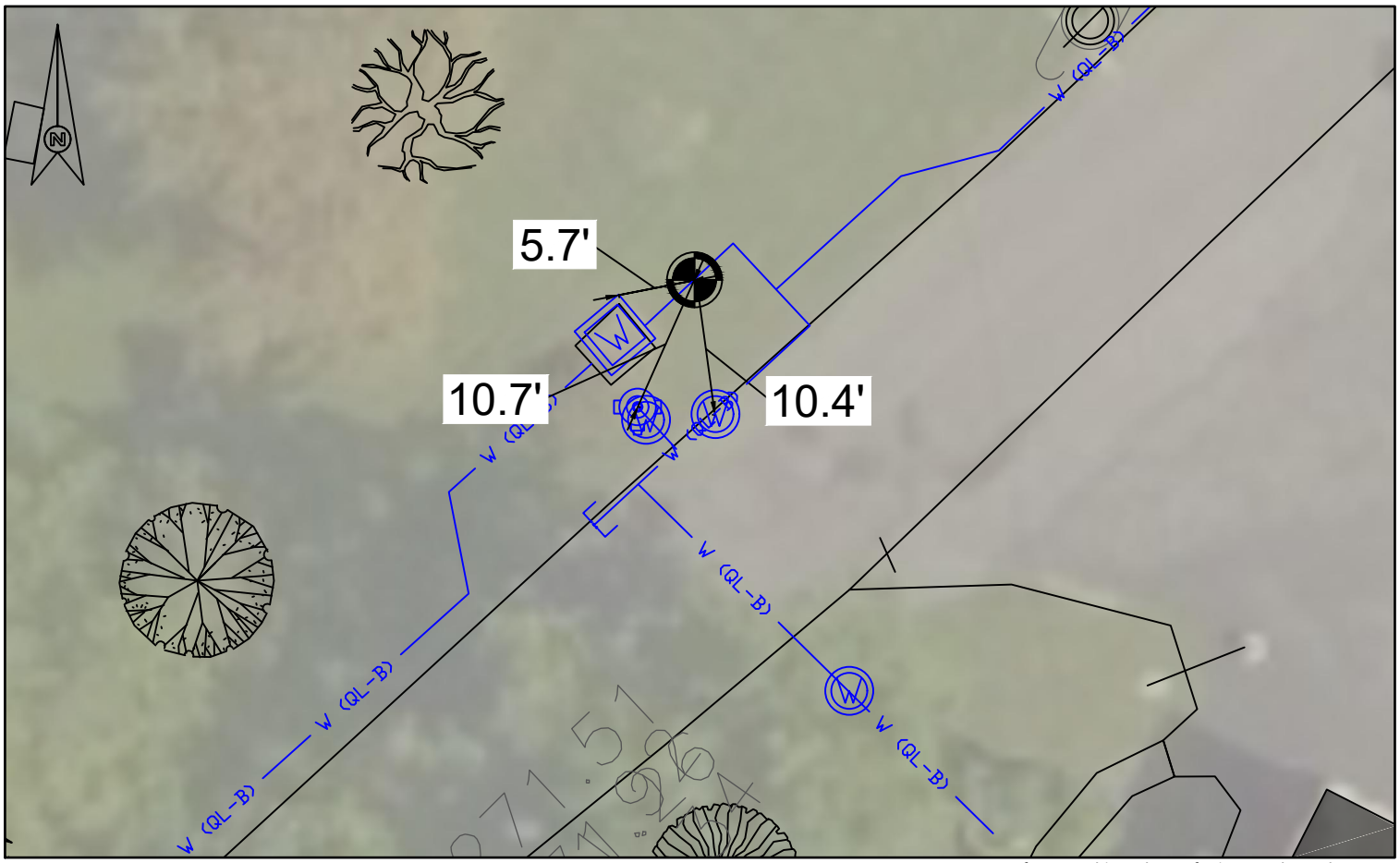
Observed Utility Condition: Good

Surface Covering: Soil Yes Asphalt 0 Concrete 0 Other N/A

Northing: 796570.2318 Easting: 678195.8382




## TEST HOLE PLAN




Prepared by: R. Selke

Date: 3/23/21

Surface markings by SoftDig or others do not necessarily indicate true location or depth

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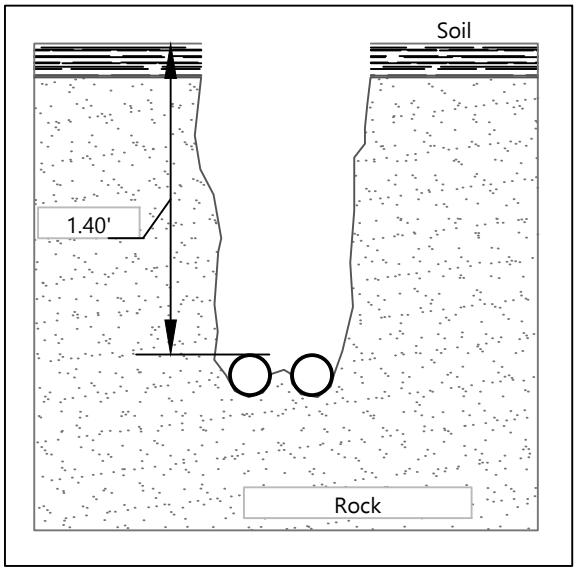
(877)SOFTDIG
www.softdig.com
softdig@softdig.com

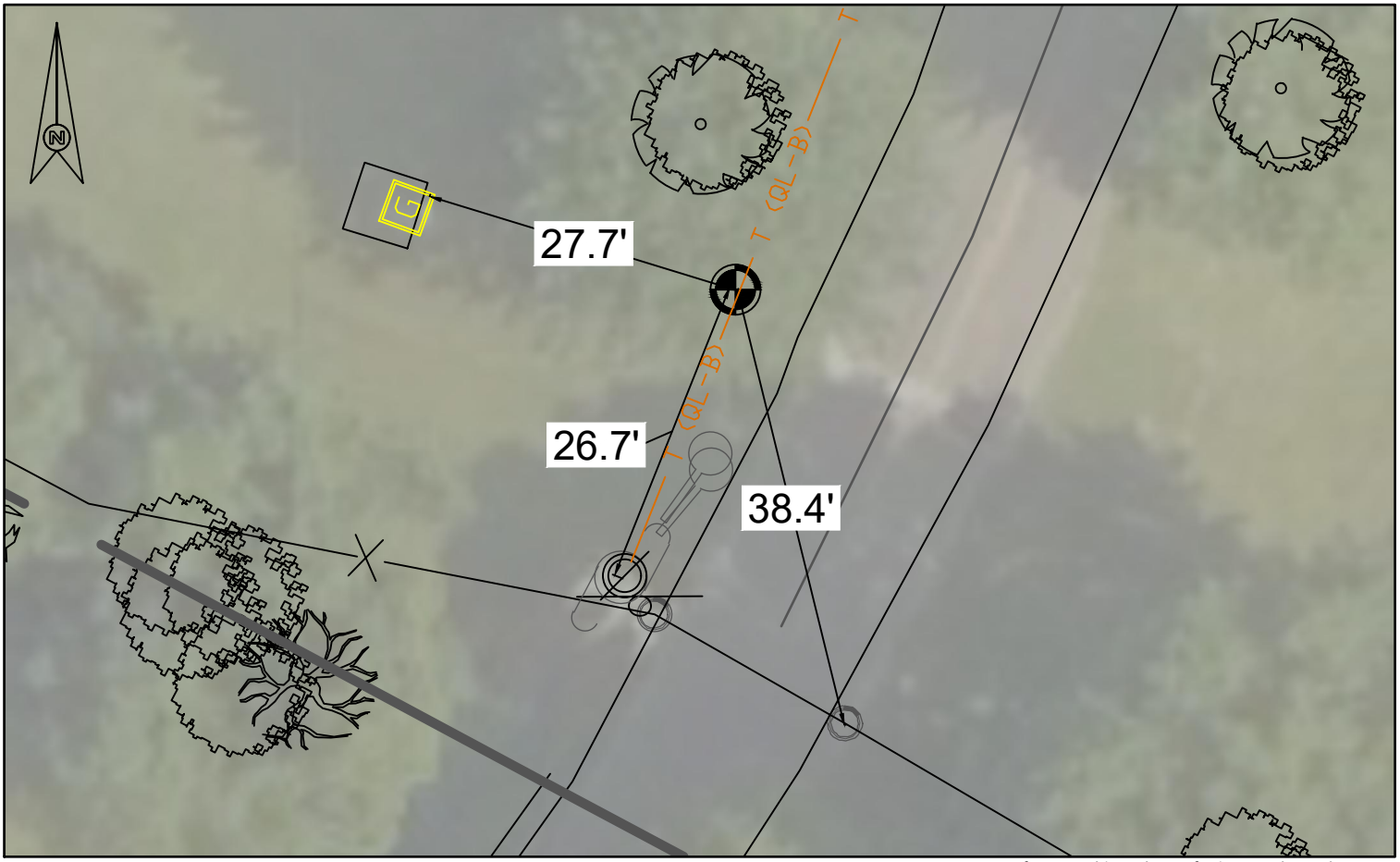
SoftDig Project #: 107890-1 Test Hole #: 2A Client: Weston & Sampson Date: 3/16/21
One-Call Permit: N/A Crew: R. Johnson, J. Andrew Truck #: S-144
City / County / State: Ardsley Westcheaster County NY Road: Olympic Drive
General Location: near Bldg 220 and the Pool House Anticipated Utility: Communications

## TEST HOLE INFORMATION

Utility Description: (2) 2" Black Communications Conduits
Utility Owner: Verizon Marker Paint: Orange
Surface Elevation at Survey Mark: 96.08' Wooden Hub
Utility Top Elevation: 94.68'
Utility Bottom Elevation: N/A
Width (For Duct Bank): N/A Type: N/A
Utility Top Depth From Surface: 1.40'
Utility Bottom Depth From Surface: N/A
Benchmark Elevation: 100.00' Type: Assumed
Description: Sanitary Sewer Manhole
Observed Utility Condition: Good
Surface Covering: Soil Yes Asphalt 0 Concrete 0 Other N/A
Northing: 796712.0419 Easting: 678311.2337




## TEST HOLE PLAN




Prepared by: R. Selke
Date: 3/24/21

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# SoftDig Underground Services, Inc.

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ENGLISH UNITS

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www.softdig.com
softdig@softdig.com

SoftDig Project #: 107890-1 Test Hole #: 2B Client: Weston & Sampson Date: 3/16/21

One-Call Permit: N/A Crew: R. Johnson, J. Andrews Truck #: S-144

City / County / State: Ardsley Westchester County NY Road: Olympic Lane

General Location: between Bldg 220 and Pool House Anticipated Utility: Gas

## TEST HOLE INFORMATION

Utility Description: 2½" Black Plastic Gas Pipe

Utility Owner: Unknown Marker Paint: Yellow

Surface Elevation at Survey Mark: 96.15' Wooden Hub

Utility Top Elevation: 92.75'

Utility Bottom Elevation: N/A

Width (For Duct Bank): N/A Type: N/A

Utility Top Depth From Surface: 3.40'

Utility Bottom Depth From Surface: N/A

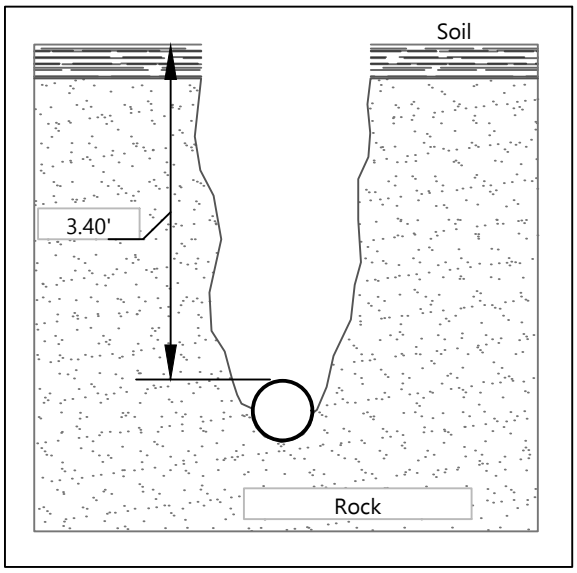
Benchmark Elevation: 100.00' Type: Assumed

Description: Sanitary Sewer Manhole

Observed Utility Condition: Good

Surface Covering: Soil Yes Asphalt 0 Concrete 0 Other N/A

Northing: 796711.0530 Easting: 678311.8572




## TEST HOLE PLAN

Prepared by: R. Selke

Date: 3/24/21

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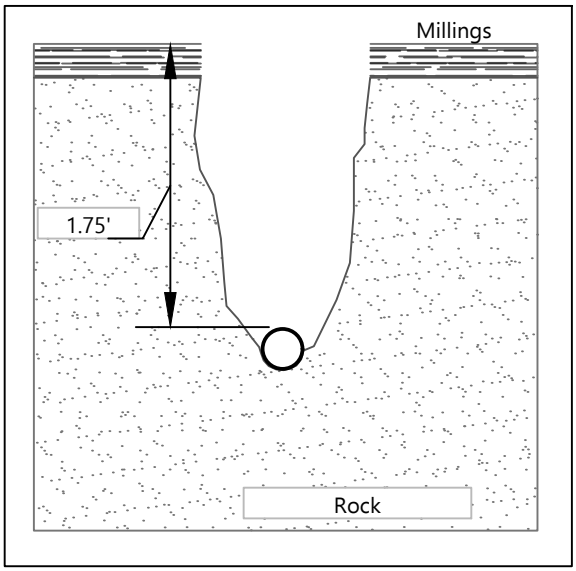
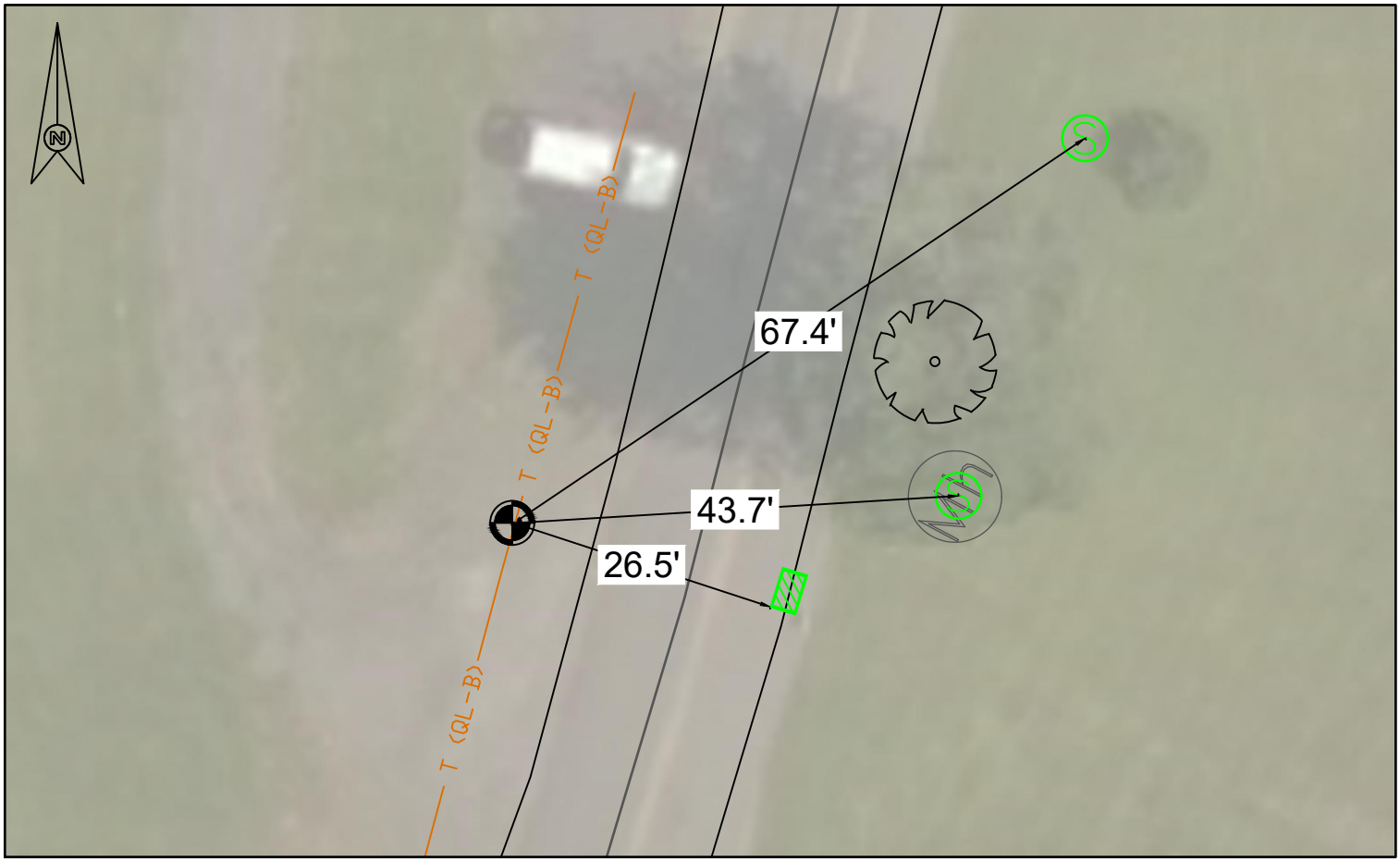
SoftDig Project #: 107890-1 Test Hole #: 3 Client: Weston & Sampson Date: 3/16/21
One-Call Permit: N/A Crew: R. Johnson, J. Andrews Truck #: S-144
City / County / State: Ardsley Westchester County NY Road: Olympic Lane
General Location: between Bldg 220 and Pool House Anticipated Utility: Communications

## TEST HOLE INFORMATION

Utility Description: 4" White PVC Communications Conduit
Utility Owner: Verizon Marker Paint: Orange
Surface Elevation at Survey Mark: 101.48' PK Nail
Utility Top Elevation: 99.73'
Utility Bottom Elevation: N/A
Width (For Duct Bank): N/A Type: N/A
Utility Top Depth From Surface: 1.75'
Utility Bottom Depth From Surface: N/A
Benchmark Elevation: 100.00' Type: Assumed
Description: Sanitary Sewer Manhole
Observed Utility Condition: Good
Surface Covering: Soil No Asphalt 6" Concrete 0 Other Millings
Northing: 796786.8133 Easting: 678336.8408




## TEST HOLE PLAN

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Date: 3/24/21

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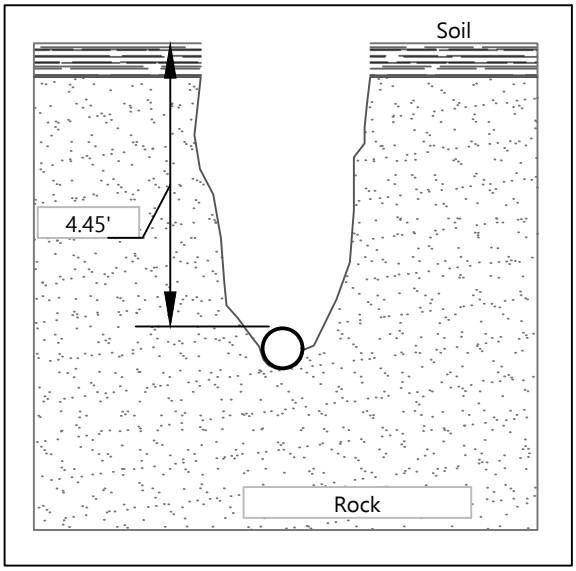
softdig@softdig.com

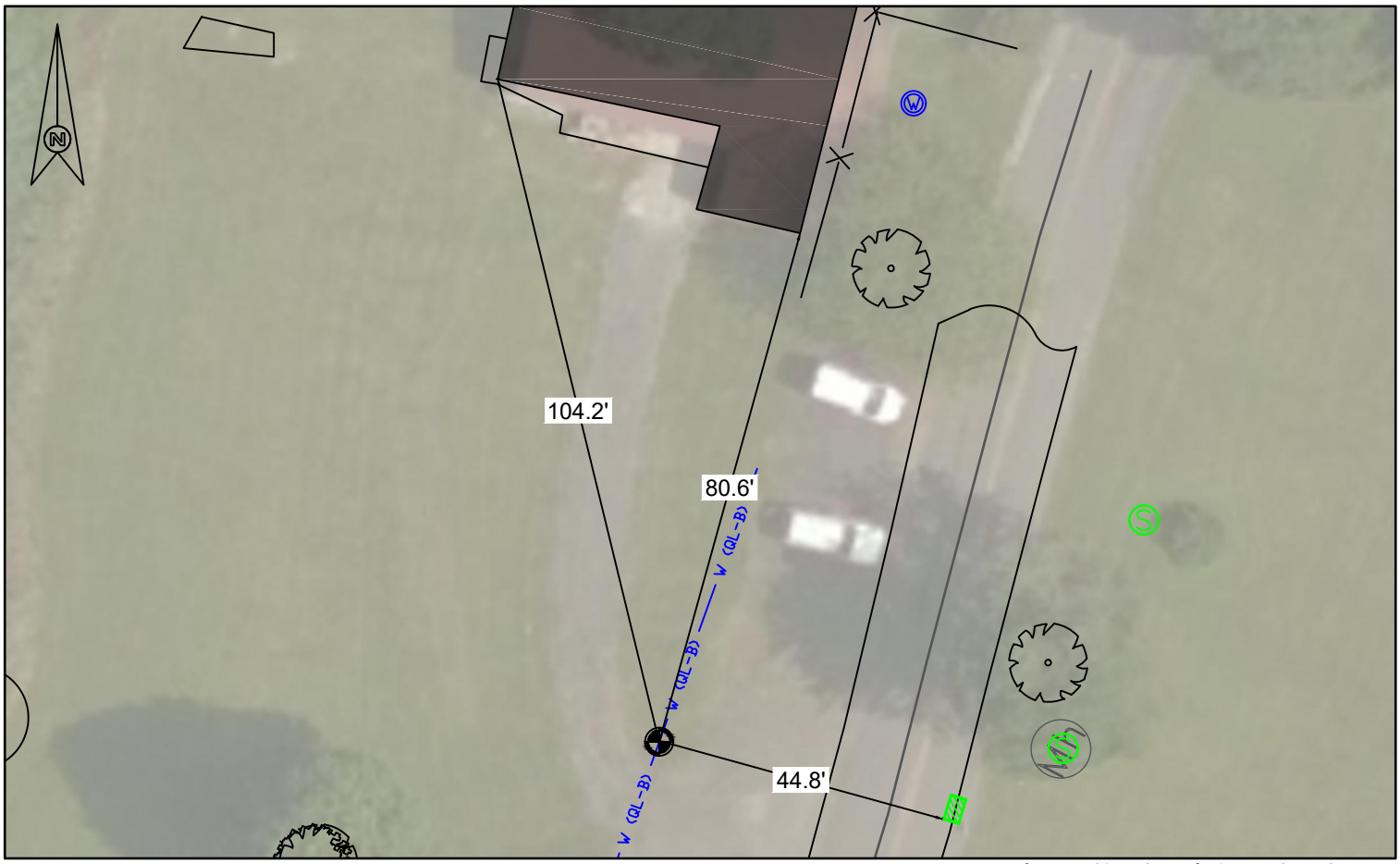
SoftDig Project #: 107890-1 Test Hole #: 4 Client: Weston & Sampson Date: 3/16/21
One-Call Permit: N/A Crew: R. Johnson, J. Andrews Truck #: S-144
City / County / State: Ardsley Westchester County NY Road: Olympic Lane
General Location: between Bldg 220 and Pool House Anticipated Utility: Water

## TEST HOLE INFORMATION

Utility Description: 1" Gray Metal Water Pipe
Utility Owner: Greensburgh Twp Marker Paint: Blue
Surface Elevation at Survey Mark: 99.83' Wooden Hub
Utility Top Elevation: 95.38'
Utility Bottom Elevation: N/A
Width (For Duct Bank): N/A Type: N/A
Utility Top Depth From Surface: 4.45'
Utility Bottom Depth From Surface: N/A
Benchmark Elevation: 100.00' Type: Assumed
Description: Sanitary Sewer Manhole
Observed Utility Condition: Good
Surface Covering: Soil Yes Asphalt 0 Concrete 0 Other N/A
Northing: 796790.4591 Easting: 678318.6762




## TEST HOLE PLAN




Prepared by: R. Selke
Date: 3/24/21

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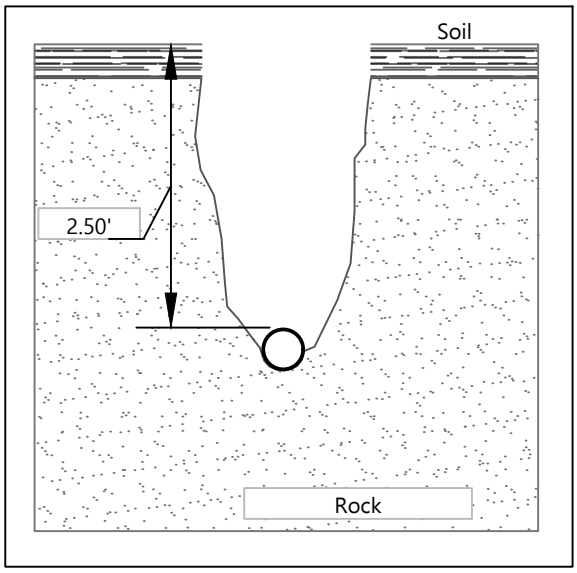
softdig@softdig.com

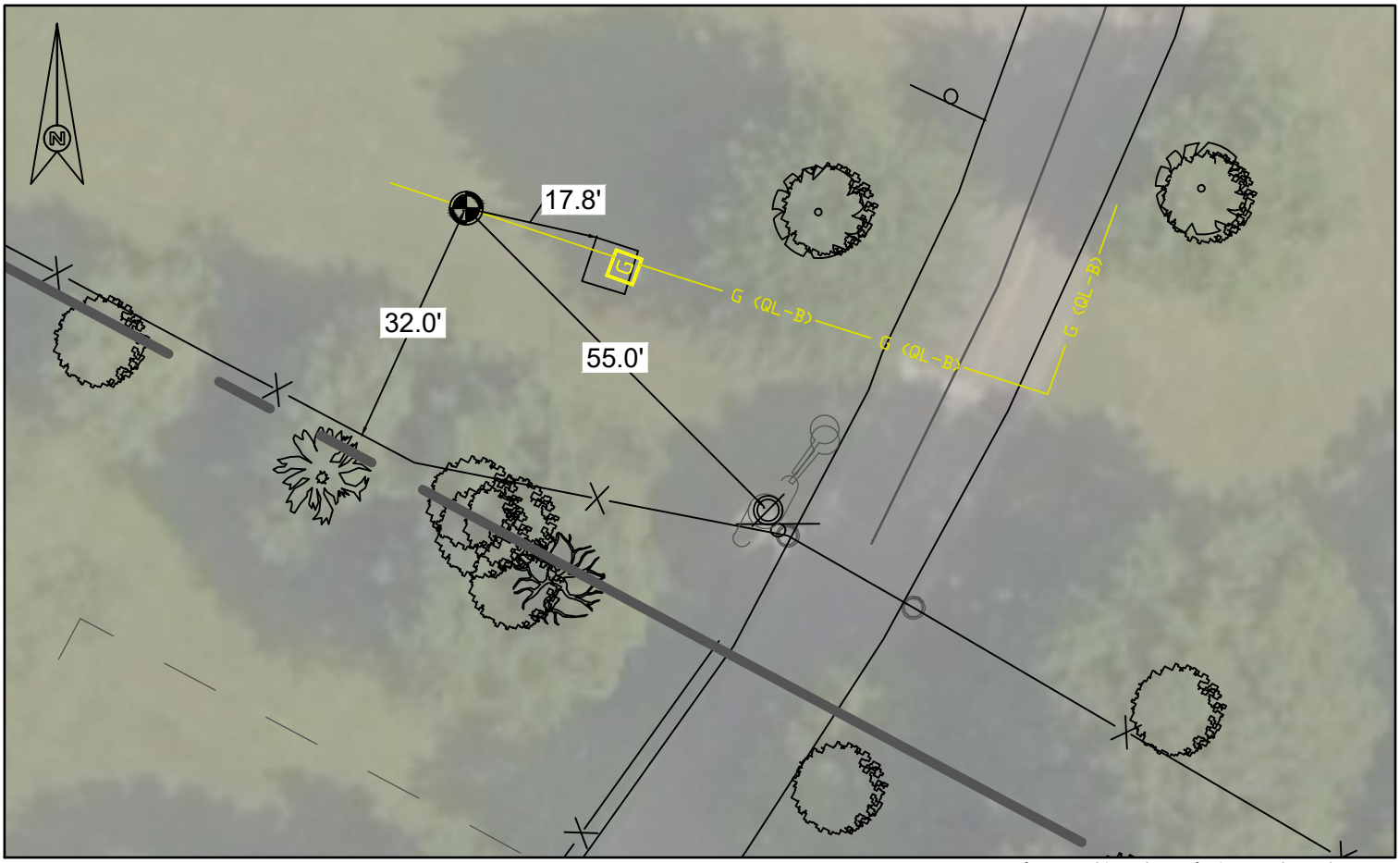
SoftDig Project #: 107890-1 Test Hole #: 5 Client: Weston & Sampson Date: 3/16/21
One-Call Permit: N/A Crew: R. Johnson, J. Andrews Truck #: S-144
City / County / State: Ardsley Westchester County NY Road: Olympic Lane
General Location: near Bldg 220 Anticipated Utility: Gas

## TEST HOLE INFORMATION

Utility Description: 2½" Black Plastic Gas Pipe
Utility Owner: Unknown Marker Paint: Yellow
Surface Elevation at Survey Mark: 90.89' Wooden Hub
Utility Top Elevation: 88.39'
Utility Bottom Elevation: N/A
Width (For Duct Bank): N/A Type: N/A
Utility Top Depth From Surface: 2.50'
Utility Bottom Depth From Surface: N/A
Benchmark Elevation: 100.00' Type: Assumed
Description: Sanitary Sewer Manhole
Observed Utility Condition: Good
Surface Covering: Soil Yes Asphalt 0 Concrete 0 Other N/A
Northing: 796726.7666 Easting: 678262.4201




## TEST HOLE PLAN




Prepared by: R. Selke
Date: 3/24/21

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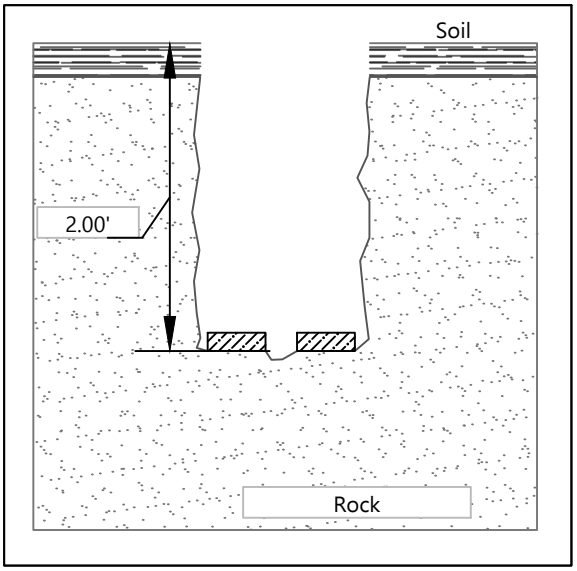
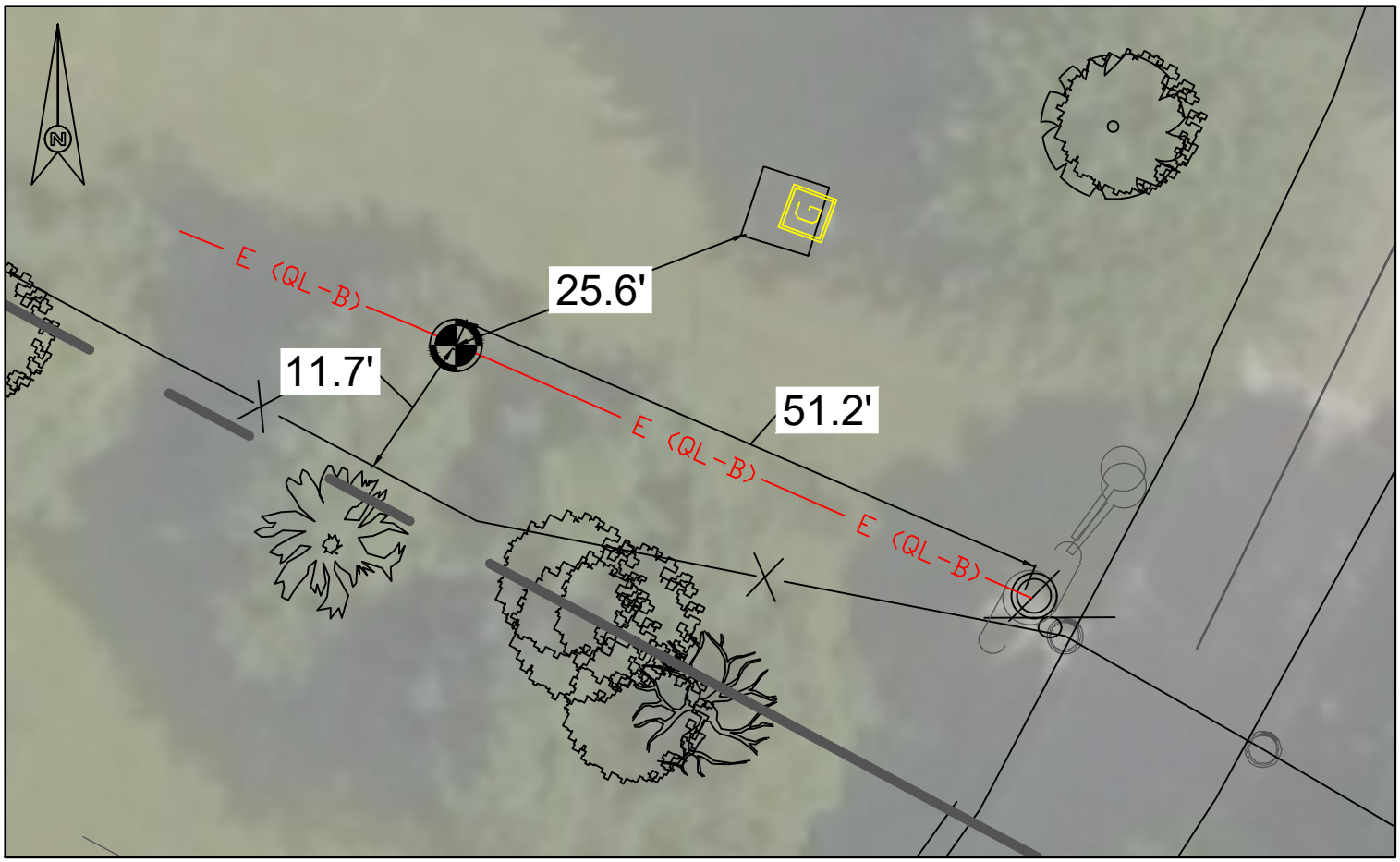
SoftDig Project #: 107890-1 Test Hole #: 6 Client: Weston & Sampson Date: 3/16/21
One-Call Permit: N/A Crew: R. Johnson, J. Andrews Truck #: S-144
City / County / State: Ardsley Westchester County NY Road: Olympic Lane
General Location: edge of roadway near Bldg 220 Anticipated Utility: Electric

### TEST HOLE INFORMATION

Utility Description: (2) 6" Wooden Covers over Electric / Communications
Utility Owner: Unknown Marker Paint: Red and Orange
Surface Elevation at Survey Mark: 89.77' Wooden Hub
Utility Top Elevation: 87.77'
Utility Bottom Elevation: N/A
Width (For Duct Bank): N/A Type: N/A
Utility Top Depth From Surface: 2.00'
Utility Bottom Depth From Surface: N/A
Benchmark Elevation: 100.00' Type: Assumed
Description: Sanitary Sewer Manhole
Observed Utility Condition: Good
Surface Covering: Soil Yes Asphalt 0 Concrete 0 Other N/A
Northing: 796708.1706 Easting: 678253.9424




### TEST HOLE PLAN

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Date: 3/24/21

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