
PROJECT MANUAL



OSSINING UNION FREE SCHOOL DISTRICT

OSSINING HIGH SCHOOL 3RD FLOOR CONNECTOR

OSSINING HIGH SCHOOL, 29 S. HIGHLAND AVENUE, OSSINING, NY 10562

CPL PROJECT NO: 14428.13

DOCUMENT DATE: MARCH 12, 2021

SED PROJECT NO: 66-14-01-03-0-003-040

DESIGN PROFESSIONAL'S CERTIFICATION

The undersigned certifies that, to the best of his or her knowledge, information and belief, the design conforms to all applicable provisions of the Building Code of New York State, the New York State Energy Conservation Construction Code, and the Manual of Planning Standards of the New York State Education Department.

ARCHITECT/ENGINEER

CLARK PATTERSON LEE
50 FRONT STREET
NEWBURGH, NY 12550
(800) 274-9000 - PH

OWNER

OSSINING UNION FREE SCHOOL DISTRICT
400 Executive Boulevard
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END OF SECTION 00 0110

The Ossining Union Free School District (Owner) invites bids for **“HS 3rd Floor Connector”** which involves work at the Ossining High School, 29 South Highland Avenue, Ossining, New York 10562.

Separate sealed bids will be received at Ossining Union Free School District, **400 Executive Boulevard, Ossining, New York 10562**, until **3:00 P.M.** (local time) **December 14, 2021**. Bids received after that time will not be accepted. To accommodate social distancing measures, the Owner will have a virtual bid opening starting at the time noted above:

Zoom Meeting Link:

<https://us04web.zoom.us/j/77295519714?pwd=ai9TQzlvTjhEeUhrQ3lCVmEySm dpZz09>

Meeting ID: 772 9551 9714

Passcode: 10562

The Work of the project will be let for the following Contracts:

Contract 1: GENERAL CONSTRUCTION WORK

Contract 2: HVAC WORK

Contract 3: ELECTRICAL WORK

Complete digital sets of Bidding Documents may be obtained online as a download at www.cplplanroom.com under 'public projects' for a non-refundable reproduction fee of \$49.00.

Complete sets of Bidding Documents may be obtained from Rev, 330 Route 17A, Suite #2, Goshen, New York 10924 Tel: 1-877-272-0216, upon depositing the sum of \$100 for each combined set of documents. Checks or money orders shall be made payable to Ossining Union Free School District. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

Bidders may obtain Bid Documents via the methods described above beginning **November 19, 2021**.

All bid addenda will be transmitted to registered plan holders via email and will be available at www.cplplanroom.com. Plan holders who have paid for hard copies of the bid documents will need to make the determination if hard copies of the addenda are required for their use, and coordinate directly with the printer for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.

A Bidder, upon 1) making the deposit required for the Bid Documents, 2) submitting a Proposal accompanied by a certified check or other security in accordance with the requirements contained in the plans and specifications and public advertisement for bids, and 3) returning the plans and specifications used by such Bidder in good condition within thirty (30) days following the award of the Contract, or rejection of the Bid, shall have returned to them the full amount of the deposit for one copy of the plans and specifications.

A Pre-Bid Meeting/walk-through for the Project will be held **November 30, 2021, starting at 4:00 P.M.** at the site. Attendance by bidders is recommended, but not required, for submitting a bid. Prospective bidders may visit the site during business hours by appointment by contacting the Construction Manager (contact Frank Roberts, 914-755-0930).

Attention of the Bidder is particularly called to the Owner's sales tax exemption, the requirements as to conditions of employment to be observed, and the minimum wage rates to be paid under the Contract. In addition, the Bidding Documents contain detailed requirements for the qualification of Bidders. These include, among other things, rigid bonding and insurance requirements, financial statements, bank

references, lists of lawsuits, arbitrations or other proceedings in which the Bidder has been named as a party, a statement of surety's intent to issue Performance and Payment Bonds, and a description of other projects of similar size and scope completed by the Bidder.

Bids shall be prepared as set forth in “INSTRUCTIONS TO BIDDERS”, enclosed in a sealed envelope bearing on its face the name and address of the Bidder and the title of the Work to which the bid enclosed relates.

Each Bidder shall deposit with its bid, security in an amount not less than five percent (5%) of the base bid in the form and subject to the conditions provided in the “INSTRUCTIONS TO BIDDERS.”

No Bidder may withdraw his bid within forty-five (45) days after the actual bid opening.

The Owner reserves the right to waive any and all informalities in, or to reject, any or all bids.

The Owner further reserves its right to disqualify Bidders for any material failure to comply with the “INSTRUCTIONS TO BIDDERS” and “SUPPLEMENTARY INSTRUCTIONS TO BIDDERS.”

**OSSINING UNION FREE SCHOOL DISTRICT
400 EXECUTIVE BOULEVARD
OSSINING, NEW YORK 10562**

END OF SECTION 00 1112

SECTION 00 2000 INSTRUCTIONS TO BIDDERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Attached is AIA Document A701-2018, Instructions to Bidders.
 - 1. AIA Document A701-2018 defines the conditions affecting award of contract and procedures with which Bidders must comply.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION 00 2000**

AIA® Document A701™ – 2018

Instructions to Bidders

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

3rd Floor Connector
Ossining High School
29 South Highland Avenue
Ossining, New York 10562

SED Project #: 66-14-01-03-0-003-040

THE OWNER:
(Name, legal status, address, and other information)

Ossining Union Free School District
400 Executive Boulevard
Ossining, New York 10562

THE ARCHITECT:
(Name, legal status, address, and other information)

CPL
50 Front Street, Suite 202
Newburgh, New York 12550

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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.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

§ 2.2 To be considered qualified, the Bidder must demonstrate to the Owner's satisfaction the following:

1. The corporation, partnership, sole proprietorship or other business entity in whose name the Bid is submitted has been in business, continuously, for no less than the previous five (5) years performing or coordinating the work which it is bidding on;
2. The Bidder has satisfactorily completed no less than five (5) projects of comparable size, complexity and type to this Project as a prime contractor to project owner;
3. The Bidder is licensed to perform the work it is bidding on in the jurisdiction where the work will take place;
4. The Bidder is capable of and intends to perform at least 25% of the work with its own forces;
5. The Bidder has sufficient manpower available to it to perform the work.

6. The Bidder and its subcontractors have a minimum of five (5) years' experience in the work and applicable trades.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

(Paragraph deleted)

§ 3.1.2 Bidders may obtain one complete set of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid for the deposit sum of \$50.00. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within thirty (30) days following the award of the Contract or rejection of the Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded. Good condition as used in this section means that the Bidding Documents must be returned bound as issued, legible, and containing only the markings necessary for bidding purposes.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven calendar days prior to the date for receipt of Bids. The day the bids are due shall not be counted as one of the seven days referred to.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on the Substitution Request Form is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than three days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids. The day the bids are due shall be counted as one of the three days referred to.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

§ 3.5 EQUIVALENCY

§ 3.5.1 In the Specifications, if two or more kinds, types, brands, or manufacturers or materials are named, they shall be regarded as the required standard of quality, and are presumed to be equal. The Contractor may select one of these items or, if the Contractor desires to use any kind, type, brand, manufacturer or material other than those named in the Specification, he shall indicate in writing to the Architect and Owner, and prior to the award of Contract, what kind, type, brand or manufacturer is included in the Base Bid for the specified item.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the 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 name 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.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.1.9 Each bid must include a fully executed copy of the Insurance Certification Form (See Section 00 4980). Failure to include with the bid may result in the Owner finding the Contractor "non-responsive" to the bid documents.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a Bid Security in the form and amount required. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2. .

§ 4.2.1.1 Bids shall be accompanied by a Bid Security of not less than five percent (5%) of the amount of the Bid. Such Bid Security shall be submitted in the form of a Bid Bond or a Certified Check made payable to the Owner. The submission shall be made with the understanding that the Bid Security shall guarantee that the Bidder will not withdraw its Bid for a period of forty-five (45) days after the scheduled closing time for the receipt of Bids, and that if its Bid is accepted, the Bidder will enter into a formal contract with the Owner in accordance with the terms stated in the Bid and will furnish any required performance and payment bonds at the time required. In the event of the withdrawal of said Bid within the forty-five (45) day period or the failure of the successful Bidder to enter into the Contract with the Owner or the failure of the successful Bidder to furnish required performance and payment bonds at the time required, the Bid Security shall be forfeited to the Owner as liquidated damages, not as a penalty, which represents the damage the Owner incurred as a result of the Bidder's default.

§ 4.2.1.2 The Bid Securities shall be returned to all Bidders except the three (3) lowest Bidders within three (3) days after the formal opening of bids. The remaining Bid Securities will be returned within forty-eight (48) hours after the Owner and the successful Bidder have executed the Contract and executed performance and payment bonds have been approved by the Owner. If a Contract has not been executed or performance and payment bonds have not been approved by the Owner within forty-five (45) days after the scheduled closing time for the receipt of bids, then Bid Securities will be returned within three (3) days after the expiration of this forty-five (45) day period unless the Bid Security has been forfeited under § 4.2.1.1.

§ 4.2.2 If the Bid Security is provided in the form of a Bid Bond (rather than a certified check), it shall be written on AIA Document A310, Bid Bond, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

(Paragraphs deleted)

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1

(Paragraphs deleted)

All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.3.5 Each bidder on a single-prime work contract shall submit with its bid a separate sealed list that names each subcontractor that the bidder will use to perform work on the contract, and the agreed-upon amount to be paid to each, for: (a) plumbing and gas fitting, (b) steam heating, hot water heating, ventilating and air conditioning apparatus and (c) electric wiring and standard illuminating fixtures. After the low bid is announced, the sealed list of subcontractors submitted with such low bid shall be opened and the names of such subcontractors shall be announced, and thereafter any change of subcontractor or agreed-upon amount to be paid to each shall require the approval of the public owner, upon a showing presented to the public owner of legitimate construction need for such change, which shall be open to public inspection. Legitimate construction need shall include, but not be limited to, a change in project specifications, a change in construction material costs, a change to subcontractor status as determined pursuant to paragraph (e) of subdivision two of section two hundred twenty-two of the labor law, or the subcontractor has become otherwise unwilling, unable or unavailable to perform the subcontract. The sealed lists of subcontractors submitted by all other bidders shall be returned to them unopened after the contract award.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.2.1 The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform its obligations under the Contract, and the Bidder shall furnish the Owner all such information and data for this purpose as the Owner may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified and capable to carry out properly the terms of the Contract. The issuing of Bid Documents and acceptance of the Bidder's payment by the Owner shall not be construed as pre-qualification of that Bidder. If the Bidder is later discovered to have misrepresented or provided false or incorrect information with regard to any material part of the information submitted to the Owner, including but not limited to information regarding experience, debarment, claims, lawsuits, arbitrations, mediations, finances, license, contract termination, the Owner reserves the right to reject the Bid of such Bidder and, if a construction contract has been awarded, it will become automatically voidable at the sole discretion and election of the Owner.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

- .1 The Owner may also reject any Bid not prepared and submitted in accordance with all provisions of the Bidding Documents.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

(Paragraphs deleted)

§ 6.3 Submittals

§ 6.3.1 CONTRACTOR'S QUALIFICATION INFORMATION – The apparent low bidder must submit the required pre-award submittal package described below to the Construction Manager within 48 hours after the bids are opened.

Arris Contracting Co., Inc.
189 Smith Street
Poughkeepsie, NY 12601
845-473-3600

Submissions must be emailed and must include the Project Name of this contract in the Subject Line of the Pre-Award submission email.

(1) Pre-award Submittal Package

- (i) Fully executed AIA A305 Contractors Qualification Statement (to be submitted with the bid).
- (ii) Most recent financial statement certified by CPA.
- (iii) References and Experience:
 1. List of all past contracts with K-12 Public School Districts (Provide Architect & CM Contact Information)
 2. Provide three (3) references (Name, Title, and Phone Number) associated with three (3) different projects (public or private sector) of similar scope and size to the one identified in this contract. Additionally, include the names of two major suppliers used for each of these three (3) projects.

(2) Workforce and Work Plan – Provide a detailed written Work Plan which shall demonstrate the contractor's understanding of overall project scope and shall include, but not be limited to, the following

- (i) Sequential listing of specific project activities required to successfully complete the Work of the contract.
 1. Include Critical Milestones
 2. Narrative of project work plan, sequencing, etc.
 3. Include phasing of the Work, if required.
 4. Include listing of long lead items.
 5. Statement that the project can be completed in established time.
- (ii) Resumes for Contractor's proposed supervisory staff, including qualifications for specialized expertise or any certification(s) required to perform the Work.
- (iii) Names of proposed sub-contractors and a listing of the related trade of work and value.
- (iv) Any special coordination requirements with other trades.
- (v) Any special storage and staging requirements for construction materials.

(3) Detailed Cost Estimate:

- (i) A copy of a Detailed Cost Estimate outlined in CSI format.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 The Bidder shall furnish bonds covering the faithful performance of the Contract (performance bond) and payment of all obligations arising thereunder (payment bond). Bonds may be secured through the Bidder's usual sources unless otherwise required in writing. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Bid and Contract Sum. The amount of each bond shall be equal to one hundred (100) percent of the Contract Sum.

§ 7.1.2 The cost of furnishing performance and payment bonds shall be included in the Bid and Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost shall be adjusted and included in the Bid and Contract Sum.

(Paragraphs deleted)

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than ten (10) days after the Bidder has received notice of the acceptance of its Bid but in no event shall bonds be delivered later than the date of the executed Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise required in writing, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. The amount of each bond shall be equal to one hundred (100) percent of the Contract Sum.

- .1 The Performance and Payment Bonds shall have as surety thereunder such surety company or companies as are acceptable to Treasury Department of the United States on Bonds given to the United States Government, and are authorized to do business in the State of New York. Premium on such Bonds shall be included in the Bid.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 All Specification Sections and Drawings Listed in Section 00 01 10 Table of Contents.

ARTICLE 9: TAXES

(Paragraphs deleted)

GENERAL INSTRUCTIONS TO BIDDERS

1. Sealed proposals for the furnishing, delivery and installation of the various items of equipment or supplies, as required by the Ossining Union Free School District, as set forth in the attached specifications, will be opened on the date noted in Section 00 1112 Advertisement for Bids.
2. The completed bid form shall be without interlineations, alterations, or erasures. No oral, telephonic, or telegraphic proposals or modifications will be considered. No conditions or limitations shall be added to any bid.

No interpretation of the meaning of the specifications or other contract documents will be made to any bidder orally. Any or all such interpretations and any supplemental instructions will be in the form of written addenda. See Section 00 2000 for additional information.

Failure of any bidder to receive any such addenda or interpretation shall not relieve any bidder from any obligation under this bid as submitted. All addenda issued shall become a part of the contract document.

Bids will be processed and tallied based on the information submitted and supplemental information will not be accepted after the bids are opened.

3. All parts of the invitation to bid and information for bidders shall become a part of the specifications.
4. Samples, if substitutes are bid, must be furnished at the bidder's expense. The Board of Education reserves the right to require any or all bidders to submit samples for inspection and test.

Damaged or rejected items will be returned at bidder's expense.

5. All items delivered and/or installed must meet the requirements of the specifications. The Board of Education reserves the right to have the Director of School Facilities, Operations and Maintenance, inspect each item as it is received and unpacked prior to placing and setting or installation and to require prompt removal or replacement of any items not according to specifications or otherwise unsatisfactory.
6. All prices quoted will be final cost to the District. Price shall not include state or federal excise taxes.

All bids submitted shall include all expenses of delivery and erection of all materials when so indicated and specified.

7. Each bidder must state that no officer of the school district or member of the Board of Education is directly or indirectly financially interested in the proposal, or any portion of the profits.

Bidder shall execute and seal the Bid Proposal Certifications (see Section 00 4960).

8. The Board of Education reserves the right to reject any or all bids and to accept any or all combinations of the bid deemed to be in the best interest of the Ossining Union Free School District, Ossining, New York.

9. No bidder may withdraw his bid for a period of forty-five (45) days after the date set for the opening.

All awards will be made as soon as possible.

10. All bids must be enclosed in a sealed envelope, and plainly marked with the name of bidder.

Bids received late will be returned to the sender unopened.

11. Payment shall be made in full as early as accounting practices will permit (approximately 30 days) after entire order has been delivered and/or installed in the specified areas, checked out for proper functioning, and other conditions of these specifications met in full to the satisfaction of the Board of Education. With each application for payment a certified payroll must be submitted. After the first application for payment partial release of lien is required.

12. The Board's Right to do Work - Should the contractor neglect to properly prosecute the work or fail to perform any provision of this contract, the Board may after three days' notice in writing being given the contractor, without prejudice to any other remedy the Board may have, make good such deficiencies and may deduct the cost thereof from payments then or thereafter due the contractor.

13. At the time of the opening of bids, each bidder will be presumed to have read and to be thoroughly familiar with the specifications, including all addenda, if any. The failure or omission of any bidder to receive and examine any form, instrument, or document, shall in no way relieve him of any obligation in respect to his bid.

15. Copies of the specifications may be obtained at the Office of the Director of School Facilities, behind Anne M. Dorner Middle School at 70 Van Cortland Avenue, Suite 100, Ossining, New York 10562.

16. Bidders shall visit the site and shall be responsible for having ascertained pertinent local conditions such as location, accessibility, and general character of the site and the building, and any other work being performed thereon at the time of submission of the bid. No claims for extra compensation based on ignorance of existing site conditions will be considered.

PLEASE NOTE: SITE LOCATION VISITS

- a. In order to visit the site location, you must contact the office of the Director of School Facilities, Operations and Maintenance, (914) 762-5740 ext. 3339, for a scheduled appointment.
- b. Any person who is not an employee of the Ossining Public Schools must sign in at the main office of that building immediately upon entering and request that a custodian accompany them.

Failure to adhere to these conditions could result in the loss of consideration in future bidding.

16. All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the owner who shall be the final judge of the quality of the work, materials, processes of manufacture, and methods of construction for the purposes for which they are used. Should they fail to meet the Owner's approval, they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the contractor at his own expense.
17. All responsibility for damage to buildings during installation shall be assumed by said bidder(s). The Board of Education or its agent shall determine such damage.
18. The contractor must comply with all laws, ordinances and codes, local or state, and must be responsible for any and all accidents that may occur to all persons in connection with this work.
19. All bidders must comply with the labor laws and are required to pay at least the minimum wage rates and supplements specified in the schedule established by the industrial commissioner.
20. Chapter 207 of the Laws of 1974 amended Section 2022 of the Labor Law provides that in the construction of public works for municipalities, including school districts, preference in employment shall be given to citizens of New York who have been residents for at least six months. If this section is not complied with, the contract will be void.
21. Contractors' attention is directed to "Contract Requirements" as set forth by Article 8 of the New York State Labor Law.

22. Notwithstanding any terms, conditions, or provisions, in any other writing between the parties, the contractor hereby agrees to effectuate the naming of the district as an unrestricted additional insured on the contractor's insurance policies, with the exception of worker's compensation and NY State disability insurance. The contractor shall require any subcontractor(s) to provide all of the requirements of this section before any work is to commence.

A. The policy naming the district as an additional insured shall:

- Be an insurance policy from an A.M. Best rated "Secured" or better, New York State admitted insurer. A New York licensed insurer is preferred. The decision to accept specific insurers lies exclusively with the district.
- Provide for 30 days' notice cancellation.
- State that the organizations coverage shall be primary and non-contributory coverage for the district, its Board, employees, and volunteers.
- The district shall be listed as an additional insured by using endorsement **CG 20 10 11 85** or equivalent. Examples of equivalent ISO additional insured endorsements include using both **CG 20 33 010 01** and **CG 20 37 10 01** together. A completed copy of the endorsement must be attached with the certificate of insurance.
- The certificate of insurance must describe the specific services provided by the contractor (e.g., roofing, carpentry, plumbing) that are covered by the commercial general liability policy and the umbrella policy.
- At the District's request, the contractor shall provide a copy of the declaration page of the liability and umbrella policies with a list of endorsements and forms. If so requested, the contractor will provide a copy of the policy endorsements and forms.
- The contractor agrees to indemnify the district for any applicable deductibles and self insured retentions.
- The insurance producer must indicate whether they are an agent for companies providing the coverage.

B. Required Insurance:

- **Commercial General Liability Insurance**
\$1,000,000 per occurrence/\$2,000,000 general and products/completed operations aggregates. The general aggregate shall apply on a per project basis.
 - **Automobile Liability**
\$1,000,000 combined single limit for owned, hired and borrowed and non-owned motor vehicles.
 - **Worker's Compensation, Employers and Liability and NYS disability Insurance**
Statutory Worker's Compensation, Employer's Liability Insurance and NYS Disability Insurance for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACCORD certificates are not acceptable.
 - **Owners Contractors Protective Insurance**
(Required for construction projects in excess of \$200,000.)
\$1,000,000 per occurrence/\$2,000,000 aggregate, with the district as the named insured.
 - **Excess Insurance**
\$1,000,000; \$3,000,000; \$5,000,000 (or higher) each occurrence and aggregate depending on the type and size of the project. Excess coverage shall be on a follow-form basis.
 - **Bid Performance and Labor & Material Bonds**
If required in the specifications, a New York State admitted Surety Company in good standing should provide these bonds.
 - **Builders Risk Insurance or Installation Floater**
Builders risk coverage can be provided by NYSIR, or required of the contractors. Installation floaters are provided by the contractor(s).
- C. Contractor acknowledges that failure to obtain such insurance on behalf of the district constitutes a material breach of contract and subjects it to liability for damages, indemnification, and all other legal remedies available to the district. The contractor is to provide the district with a certificate of insurance, evidencing the above requirements have been met, no less than two (2) weeks prior to the commencement of work.
- D. The district is a member/owner of the NY Schools Insurance Reciprocal (NYSIR). The contractor further acknowledges that the procurement of such insurance as required herein is intended to benefit not only the district but also the NYSIR, as the district's insurer.
23. The enclosed fully executed Hold Harmless Agreement and Prevailing wage Agreement shall be submitted with each bid.
24. The successful bidder must deliver to the owner executed bonds in an approved form and in the amount of one hundred (100%) per cent of the accepted bid as security for faithful performance of his contract and for the payment of all persons performing labor or furnishing materials in accordance therewith, having as surety thereon such surety company or companies as are approved by the owner, and are licensed and

authorized to do business in the State of New York, and are approved by the New York State Insurance Department.

25. Power of Attorney: Attorneys-in-fact who sign contract bonds must file with each bond a certified copy of their power of attorney to sign said bonds.

END OF SECTION 00 2010

SECTION 00 3000 REQUESTS FOR CLARIFICATION OF BID DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Requests for clarifications of the Bid Documents shall be submitted by Bidders to the Construction Manager via email (send to froberts@arriscontracting.com). Requests shall include the following information:
1. Project Name: Ossining Union Free School District, Ossining High School, 3rd Floor Connector.
 2. Bidder's name and full contact information.
 3. Subject Specification Number.
 4. Subject Drawing Number.
 5. Clarification request/question.
- B. All valid request for clarifications will be answered via written addendum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 3000

SECTION 00 4010 - FORM OF PROPOSAL
CONTRACT 1 – GENERAL CONSTRUCTION WORK

1.1 GENERAL

- A. Pursuant to, and in compliance with, the Advertisement for Bids and the Instructions to Bidders relative thereto, and all of the Contract Documents, including any and all Addenda issued by the Architect and mailed or delivered to the Undersigned prior to the opening of Bids, whether received by the Undersigned or not, we, _____ hereby propose to furnish all plant, labor, supplies, materials and equipment incidental to **GENERAL CONSTRUCTION WORK** as required by, and in strict accord with, the applicable provisions of the Drawings and Specifications entitled **Ossining Union Free School District, Ossining High School 3RD FLOOR CONNECTOR** to the satisfaction and approval of the Architect and the Owner in accordance with the terms and conditions of the Contract Documents for the following sum:

BASE BID:

Total: (\$ _____)
_____ Dollars

1.2 TIME OF COMPLETION

- A. The Undersigned agrees, after receipt of a Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, to start work within ten (10) consecutive calendar days of said Notice of Award and will fully complete the work per Section 00 3113 Construction Schedule.
- B. Liquidated Damages: Ossining Union Free School District (Owner) and CONTRACTOR recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed by the date specified in Paragraph 1.2.A above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and CONTRACTOR agree that as Liquidated Damages for delay (but not as a penalty) CONTRACTOR shall pay Owner, **Five Hundred Dollars (\$500)** for each day that expires after the date specified in Paragraph 1.2.A above.

1.3 SCHEDULE OF WORK

- A. Scheduling of all work shall be coordinated through the District and or the District's Representative. Contractor shall coordinate their work around the District's needs.
- B. It is the District's intent to work with the Contractor and make the building available for the work to be performed within the time frame allowed.

1.4 ATTACHMENTS

- A. The Undersigned has attached the following documents to this Bid:
1. Bid Bond/Certified Check in the amount of five percent (5%) of the Base Bid.
 2. Contractor's Qualification Statement (AIA Document A305).
 3. Sexual Harassment Prevention Certification Form (see Section 00 4522).
 4. Iran Divestment Act Certification (see Section 00 4951).
 5. Bid Proposal Certifications (see Section 00 4960).
 6. Hold Harmless Agreement (see Section 00 4970).
 7. Insurance Certification Form (see Section 00 4980).
 8. Prevailing Wage Agreement (see Section 00 7343).

1.5 CHANGE ORDERS

- A. We propose and agree that the Contract Sum shall be adjusted for changes in the Contract Work, not included in unit prices, by addition of the following costs:
1. Profit and overhead as permitted in the GENERAL CONDITIONS.

1.6 ALLOWANCES: (Reference Specification Section 01 2100)

- A. The Bidder acknowledges that the Allowance applicable to this Contract is included in the Base Bid.

1.7 ALTERNATES (Reference Specification Section 01 2300):

- A. Enter a whole dollar amount, even if it is zero (\$ 0), for each ALTERNATE. Circle "ADD" or "DEDUCT" for each Alternate Bid. If neither is circled, "DEDUCT" will be assumed. Do not leave any Alternate amount blank. If any amount is blank, it will be assumed the Bidder will provide that Alternate for no change, neither increase nor decrease, in Contract Price.
- B. **Alternate No. GC-1:** Replace the ceiling at the first floor hallway.

1. ADD/DEDUCT (\$ _____)

Dollars

1.8 UNIT PRICE SCHEDULE (Reference Specification Section 01 2200):

In addition to the Work provided within the above Base Bid, the Undersigned agrees to provide the following work in accordance with the Drawings and Specifications:

- GC-1. Abatement of ACM Floor Tile
(VAT) with a field fabricated tent
enclosure as per Code Rule 56.
- a. Description: abatement of ACM
Floor Tile & mastic (VAT) to be
used as an add or deduct from
base bid quantities.
 - b. Unit of Measurement: per square
foot (SF) of VAT/Mastic. \$ _____ Per square foot.

GC-2. Abatement of ACM

Fittings/Insulation within a containment area.

a. Description: Supply and install all material and labor for abatement of ACM fittings or insulation to be used as an add or deduct from base bid quantities.

b. Unit of Measurement: per lineal \$ _____ Per lineal foot.
foot of elbow or insulation.

GC-3. Abatement of ACM

Fittings/Insulation with a field fabricated tent enclosure as per Code Rule 56 (figure up to 10 fittings per tent).

a. Description: Supply and install all material and labor for abatement of ACM fittings or insulation to be used as an add or deduct from base bid quantities.

b. Unit of Measurement: per lineal \$ _____ Per lineal foot.
foot of elbow or insulation.

GC-4. Abatement of ACM Caulking.

a. Description: Abatement of ACM caulking to be used as an add or deduct from base bid quantities.

b. Unit of Measurement: per lineal \$ _____ Per lineal foot.
foot of caulk.

1.9 NON-COLLUSIVE BIDDING CERTIFICATION

A. By submission of this bid, the bidder, and each person signing on behalf of the 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 knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,
3. No attempt has been made, or will be made, by the bidder to induce any other person, partnership or corporation to submit, or not to submit, a bid for the purpose of restricting competition.

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

1. That, attached hereto (if a corporate bidder), is a certified copy of a resolution authorizing the execution of this certificate by the signature of this bid or proposal on behalf of the corporate bidder.

Resolved that _____
(Name of Individual)

be authorized to sign and submit the bid or proposal of this corporation for the **Ossining Union Free School District, Ossining High School 3rd Floor Connector**, and to include in such bid or proposal the certificate as to non-collusion required by Section One Hundred Three (d) ((103d)) of the General Municipal Law as the act and deed of such corporation, and for any inaccuracies or misstatements in such certificate this corporate bidder shall be liable under the penalties of perjury.

The foregoing is a true and correct copy of the resolution by:

_____ Corporation at a
meeting of its Board of Directors held on the: _____ day of _____,
20 ____.

(SEAL OF THE CORPORATION)

Secretary

1.10 ACCEPTANCE

- A. When this Proposal is accepted, the Undersigned agrees to enter into a Contract with the Owner as provided in the Form of Agreement.

1.11 AFFIRMS

- A. The Undersigned affirms and agrees that this Proposal is a firm one which shall remain in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.
- B. The Undersigned acknowledges the receipt of the prevailing wage rates for the Contract which are incorporated into the Contract Documents.
- C. The Undersigned understands that the Owner reserves the right to accept or reject any or all Proposals and to waive any informalities in the bidding.
- D. 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 the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-G of the New York State Labor Law.

1.12 TYPE OF BUSINESS

- A. The Undersigned hereby represents that it is a (check one) ☐ Corporation, ☐ Partnership, ☐ Individual. If a Corporation, then the Undersigned further represents that it is duly qualified as a Corporation under the laws of New York State and it is authorized to do business in this State.

1.13 PLACE OF BUSINESS

- A. The following is the name and address of the person to whom all notices required in connection with this Proposal may be telephoned, mailed, or delivered:

Name of Contact Person: _____

Name of Business or Firm: _____

Address: _____

Federal ID No. or Social Security Number: _____

Telephone: _____ Fax: _____

E-mail: _____ Mobile Phone: _____

1.14 EXECUTION OF CONTRACT

- A. When written Notice of Acceptance of the Proposal is mailed or delivered to the Undersigned within forty-five (45) days after the opening of Bids, or anytime thereafter should the Proposal not be withdrawn, the Undersigned, within ten (10) days, will execute the Form of Agreement with the Owner.

1.15 ADDENDA

- A. The Undersigned acknowledges the receipt of the following Addenda, but agrees that it is bound by all Addenda whether or not listed herein:

Addendum Number	Date of Addendum	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.16 ASBESTOS

- A. The bidder certifies that no asbestos or asbestos-containing materials will be incorporated into the Work of this Contract.

1.17 AUTHORIZED SIGNATURE FOR PROPOSAL

Signature: _____

Name: _____
(Typed or Printed)

Title: _____

Firm: _____
(Legal Name of Person, Single Proprietorship, Partnership, or Corporation)

Date: _____

(if Corporation, provide seal above)

END OF SECTION 00 4010

SECTION 00 4020 - FORM OF PROPOSAL
CONTRACT 2 – HVAC WORK

1.1 GENERAL

- A. Pursuant to, and in compliance with, the Advertisement for Bids and the Instructions to Bidders relative thereto, and all of the Contract Documents, including any and all Addenda issued by the Architect and mailed or delivered to the Undersigned prior to the opening of Bids, whether received by the Undersigned or not, we, _____ hereby propose to furnish all plant, labor, supplies, materials and equipment incidental to **HVAC WORK** as required by, and in strict accord with, the applicable provisions of the Drawings and Specifications entitled **Ossining Union Free School District, Ossining High School 3RD FLOOR CONNECTOR** to the satisfaction and approval of the Architect and the Owner in accordance with the terms and conditions of the Contract Documents for the following sum:

BASE BID:

Total: (\$ _____)
_____ Dollars

1.2 TIME OF COMPLETION

- A. The Undersigned agrees, after receipt of a Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, to start work within ten (10) consecutive calendar days of said Notice of Award and will fully complete the work per Section 00 3113 Construction Schedule.
- B. Liquidated Damages: Ossining Union Free School District (Owner) and CONTRACTOR recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed by the date specified in Paragraph 1.2.A above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and CONTRACTOR agree that as Liquidated Damages for delay (but not as a penalty) CONTRACTOR shall pay Owner, **Five Hundred Dollars (\$500)** for each day that expires after the date specified in Paragraph 1.2.A above.

1.3 SCHEDULE OF WORK

- A. Scheduling of all work shall be coordinated through the District and or the District's Representative. Contractor shall coordinate their work around the District's needs.
- B. It is the District's intent to work with the Contractor and make the building available for the work to be performed within the time frame allowed.

1.4 ATTACHMENTS

- A. The Undersigned has attached the following documents to this Bid:
1. Bid Bond/Certified Check in the amount of five percent (5%) of the Base Bid.
 2. Contractor's Qualification Statement (AIA Document A305).
 3. Sexual Harassment Prevention Certification Form (see Section 00 4522).
 4. Iran Divestment Act Certification (see Section 00 4951).
 5. Bid Proposal Certifications (see Section 00 4960).
 6. Hold Harmless Agreement (see Section 00 4970).
 7. Insurance Certification Form (see Section 00 4980).
 8. Prevailing Wage Agreement (see Section 00 7343).

1.5 CHANGE ORDERS

- A. We propose and agree that the Contract Sum shall be adjusted for changes in the Contract Work, not included in unit prices, by addition of the following costs:
1. Profit and overhead as permitted in the GENERAL CONDITIONS.

1.6 ALLOWANCES: (Reference Specification Section 01 2100)

- A. The Bidder acknowledges that the Allowance applicable to this Contract is included in the Base Bid.

1.7 ALTERNATES (Reference Specification Section 01 2300):

- A. Enter a whole dollar amount, even if it is zero (\$ 0), for each ALTERNATE. Circle "ADD" or "DEDUCT" for each Alternate Bid. If neither is circled, "DEDUCT" will be assumed. Do not leave any Alternate amount blank. If any amount is blank, it will be assumed the Bidder will provide that Alternate for no change, neither increase nor decrease, in Contract Price.
- B. **Alternate No. MC-1:** Provide all HVAC work relative to replacing the ceiling at the first floor hallway.

1. ADD/DEDUCT (\$ _____) Dollars

1.8 UNIT PRICE SCHEDULE (Reference Specification Section 01 2200):

In addition to the Work provided within the above Base Bid, the Undersigned agrees to provide the following work in accordance with the Drawings and Specifications:

1. Insulate steam and condensate piping, NPS 3.5" diameter and smaller where insulation was removed due to hazardous material abatement work beyond the amounts noted in Section 02 0800. \$ _____ Per lineal foot.
2. Insulate steam and condensate piping, NPS 4" diameter and larger where removed due to hazardous material abatement work beyond the amounts noted in Section 02 0800. \$ _____ Per lineal foot.

1.9 NON-COLLUSIVE BIDDING CERTIFICATION

- A. By submission of this bid, the bidder, and each person signing on behalf of the 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 knowledge and belief:
1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
 2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,
 3. No attempt has been made, or will be made, by the bidder to induce any other person, partnership or corporation to submit, or not to submit, a bid for the purpose of restricting competition.
- B. The person signing this bid or proposal certifies that he/she has fully informed himself/herself regarding the accuracy of the statements contained in this certification, and under the penalties or perjury, affirms the truth thereof, such penalties being applicable to the bidder as well as the person signing in its behalf;
1. That, attached hereto (if a corporate bidder), is a certified copy of a resolution authorizing the execution of this certificate by the signature of this bid or proposal on behalf of the corporate bidder.

Resolved that _____

(Name of Individual)

be authorized to sign and submit the bid or proposal of this corporation for the **Ossining Union Free School District, Ossining High School 3rd Floor Connector**, and to include in such bid or proposal the certificate as to non-collusion required by Section One Hundred Three (d) ((103d)) of the General Municipal Law as the act and deed of such corporation, and for any inaccuracies or misstatements in such certificate this corporate bidder shall be liable under the penalties of perjury.

The foregoing is a true and correct copy of the resolution by:

_____ Corporation at a
meeting of its Board of Directors held on the: ____ day of _____,
20 ____.

(SEAL OF THE CORPORATION)

Secretary

1.10 ACCEPTANCE

- A. When this Proposal is accepted, the Undersigned agrees to enter into a Contract with the Owner as provided in the Form of Agreement.

1.11 AFFIRMS

- A. The Undersigned affirms and agrees that this Proposal is a firm one which shall remain in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.
- B. The Undersigned acknowledges the receipt of the prevailing wage rates for the Contract which are incorporated into the Contract Documents.
- C. The Undersigned understands that the Owner reserves the right to accept or reject any or all Proposals and to waive any informalities in the bidding.
- D. 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 the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-G of the New York State Labor Law.

1.12 TYPE OF BUSINESS

- A. The Undersigned hereby represents that it is a (check one) ☐ Corporation, ☐ Partnership, ☐ Individual. If a Corporation, then the Undersigned further represents that it is duly qualified as a Corporation under the laws of New York State and it is authorized to do business in this State.

1.13 PLACE OF BUSINESS

- A. The following is the name and address of the person to whom all notices required in connection with this Proposal may be telephoned, mailed, or delivered:

Name of Contact Person: _____

Name of Business or Firm: _____

Address: _____

Federal ID No. or Social
Security Number: _____

Telephone: _____ Fax: _____

E-mail: _____ Mobile Phone: _____

1.14 EXECUTION OF CONTRACT

- A. When written Notice of Acceptance of the Proposal is mailed or delivered to the Undersigned within forty-five (45) days after the opening of Bids, or anytime thereafter should the Proposal not be withdrawn, the Undersigned, within ten (10) days, will execute the Form of Agreement with the Owner.

1.15 ADDENDA

- A. The Undersigned acknowledges the receipt of the following Addenda, but agrees that it is bound by all Addenda whether or not listed herein:

Addendum Number	Date of Addendum	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.16 ASBESTOS

- A. The bidder certifies that no asbestos or asbestos-containing materials will be incorporated into the Work of this Contract.

1.17 AUTHORIZED SIGNATURE FOR PROPOSAL

Signature: _____

Name: _____
(Typed or Printed)

Title: _____

Firm: _____
(Legal Name of Person, Single Proprietorship, Partnership, or Corporation)

Date: _____

(if Corporation, provide seal above)

END OF SECTION 00 4020

SECTION 00 4030 - FORM OF PROPOSAL
CONTRACT 3 – ELECTRICAL WORK

1.1 GENERAL

- A. Pursuant to, and in compliance with, the Advertisement for Bids and the Instructions to Bidders relative thereto, and all of the Contract Documents, including any and all Addenda issued by the Architect and mailed or delivered to the Undersigned prior to the opening of Bids, whether received by the Undersigned or not, we, _____ hereby propose to furnish all plant, labor, supplies, materials and equipment incidental to **ELECTRICAL WORK** as required by, and in strict accord with, the applicable provisions of the Drawings and Specifications entitled **Ossining Union Free School District, Ossining High School 3RD FLOOR CONNECTOR** to the satisfaction and approval of the Architect and the Owner in accordance with the terms and conditions of the Contract Documents for the following sum:

BASE BID:

Total: (\$ _____)
_____ Dollars

1.2 TIME OF COMPLETION

- A. The Undersigned agrees, after receipt of a Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, to start work within ten (10) consecutive calendar days of said Notice of Award and will fully complete the work per Section 00 3113 Construction Schedule.
- B. Liquidated Damages: Ossining Union Free School District (Owner) and CONTRACTOR recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed by the date specified in Paragraph 1.2.A above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and CONTRACTOR agree that as Liquidated Damages for delay (but not as a penalty) CONTRACTOR shall pay Owner, **Five Hundred Dollars (\$500)** for each day that expires after the date specified in Paragraph 1.2.A above.

1.3 SCHEDULE OF WORK

- A. Scheduling of all work shall be coordinated through the District and or the District's Representative. Contractor shall coordinate their work around the District's needs.
- B. It is the District's intent to work with the Contractor and make the building available for the work to be performed within the time frame allowed.

1.4 ATTACHMENTS

- A. The Undersigned has attached the following documents to this Bid:
1. Bid Bond/Certified Check in the amount of five percent (5%) of the Base Bid.
 2. Contractor's Qualification Statement (AIA Document A305).
 3. Sexual Harassment Prevention Certification Form (see Section 00 4522).
 4. Iran Divestment Act Certification (see Section 00 4951).
 5. Bid Proposal Certifications (see Section 00 4960).
 6. Hold Harmless Agreement (see Section 00 4970).
 7. Insurance Certification Form (see Section 00 4980).
 8. Prevailing Wage Agreement (see Section 00 7343).

1.5 CHANGE ORDERS

- A. We propose and agree that the Contract Sum shall be adjusted for changes in the Contract Work, not included in unit prices, by addition of the following costs:
1. Profit and overhead as permitted in the GENERAL CONDITIONS.

1.6 ALLOWANCES: (Reference Specification Section 01 2100)

- A. The Bidder acknowledges that the Allowance applicable to this Contract is included in the Base Bid.

1.7 ALTERNATES (Reference Specification Section 01 2300):

- A. Enter a whole dollar amount, even if it is zero (\$ 0), for each ALTERNATE. Circle "ADD" or "DEDUCT" for each Alternate Bid. If neither is circled, "DEDUCT" will be assumed. Do not leave any Alternate amount blank. If any amount is blank, it will be assumed the Bidder will provide that Alternate for no change, neither increase nor decrease, in Contract Price.
- B. **Alternate No. EC-1:** Provide all electrical work relative to replace the ceiling at the first floor hallway.

1. ADD/DEDUCT (\$ _____) _____ Dollars

1.8 NON-COLLUSIVE BIDDING CERTIFICATION

- A. By submission of this bid, the bidder, and each person signing on behalf of the 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 knowledge and belief:
1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
 2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,
 3. No attempt has been made, or will be made, by the bidder to induce any other person, partnership or corporation to submit, or not to submit, a bid for the purpose of restricting competition.

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

1. That, attached hereto (if a corporate bidder), is a certified copy of a resolution authorizing the execution of this certificate by the signature of this bid or proposal on behalf of the corporate bidder.

Resolved that _____
(Name of Individual)

be authorized to sign and submit the bid or proposal of this corporation for the **Ossining Union Free School District, Ossining High School 3rd Floor Connector**, and to include in such bid or proposal the certificate as to non-collusion required by Section One Hundred Three (d) ((103d)) of the General Municipal Law as the act and deed of such corporation, and for any inaccuracies or misstatements in such certificate this corporate bidder shall be liable under the penalties of perjury.

The foregoing is a true and correct copy of the resolution by:

_____ Corporation at a
meeting of its Board of Directors held on the: _____ day of _____,
20 ____.

(SEAL OF THE CORPORATION)

Secretary

1.9 ACCEPTANCE

- A. When this Proposal is accepted, the Undersigned agrees to enter into a Contract with the Owner as provided in the Form of Agreement.

1.10 AFFIRMS

- A. The Undersigned affirms and agrees that this Proposal is a firm one which shall remain in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.
- B. The Undersigned acknowledges the receipt of the prevailing wage rates for the Contract which are incorporated into the Contract Documents.
- C. The Undersigned understands that the Owner reserves the right to accept or reject any or all Proposals and to waive any informalities in the bidding.
- D. 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 the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-G of the New York State Labor Law.

1.11 TYPE OF BUSINESS

- A. The Undersigned hereby represents that it is a (check one) ☐ Corporation, ☐ Partnership, ☐ Individual. If a Corporation, then the Undersigned further represents that it is duly qualified as a Corporation under the laws of New York State and it is authorized to do business in this State.

1.12 PLACE OF BUSINESS

- A. The following is the name and address of the person to whom all notices required in connection with this Proposal may be telephoned, mailed, or delivered:

Name of Contact Person: _____

Name of Business or Firm: _____

Address: _____

Federal ID No. or Social Security Number: _____

Telephone: _____ Fax: _____

E-mail: _____ Mobile Phone: _____

1.13 EXECUTION OF CONTRACT

- A. When written Notice of Acceptance of the Proposal is mailed or delivered to the Undersigned within forty-five (45) days after the opening of Bids, or anytime thereafter should the Proposal not be withdrawn, the Undersigned, within ten (10) days, will execute the Form of Agreement with the Owner.

1.14 ADDENDA

- A. The Undersigned acknowledges the receipt of the following Addenda, but agrees that it is bound by all Addenda whether or not listed herein:

Addendum Number	Date of Addendum	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.15 ASBESTOS

- A. The bidder certifies that no asbestos or asbestos-containing materials will be incorporated into the Work of this Contract.

1.16 AUTHORIZED SIGNATURE FOR PROPOSAL

Signature: _____

Name: _____
(Typed or Printed)

Title: _____

Firm: _____
(Legal Name of Person, Single Proprietorship, Partnership, or Corporation)

Date: _____

(if Corporation, provide seal above)

END OF SECTION 00 4030

SECTION 00 4510 – ASBESTOS NOTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Attached Asbestos Notification form.
 - 1. The attached form shall be submitted to the Architect/Engineer by each Contractor in accordance with the Contract Documents prior to performing any work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 4510

Asbestos Notification

The Asbestos Hazard Emergency Response Act (AHERA) requires School Districts to inform all non-District employees (Contractors, vendors, etc.) who perform short term work in a school building of the locations of any known or assumed asbestos containing building materials in the school. Exposure to asbestos fibers can be hazardous to one's health and to the health of the building occupants. *Precautions must be taken to prevent the disturbance of asbestos containing building materials.*

The Owner has an asbestos management plan that indicates the specific locations where asbestos is known to exist.

Please proceed with caution and remember that the Owner's buildings *are for children*. No work may begin, until the Contractor certifies, by signature below, that they:

1. Have contacted the Owner to inform him of the scope of work.
2. Have been informed by the Owner of any known asbestos containing materials.
3. Will take adequate measures to prevent the disturbance of asbestos fibers to the largest extent possible.
4. Will inform any sub-contractors of the location of any asbestos containing materials and will require these sub-contractors to take adequate measures to prevent the disturbance of asbestos fibers.
5. Will immediately contact the Owner if asbestos fibers are disturbed.

Name of Contractor (Printed)

Title (Printed)

Address of Contractor (Printed)

Address of Contractor (Printed)

Signature

Date

SECTION 00 45 22 - SEXUALHARASSMENT PREVENTION CERTIFICATION FORM

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

Bidder Name: _____

Bidder Address: _____

Signature: _____

Print Name and Title: _____

Date: _____

CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

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

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

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

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

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

SIGNED

SWORN to before me this _____ day of 201____

Notary Public: _____

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

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

Name of the Bidder: _____

Address of Bidder: _____

Has bidder been involved in investment activities in Iran? _____

Describe the type of activities including but not limited to the amounts and the nature of the investments (e.g. banking, energy, real estate) _____

If so, when did the first investment activity occur? _____

Have the investment activities ended? _____

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

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

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

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

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

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

SIGNED

SWORN to before me this

_____ day of 201_____

Notary Public: _____

BID PROPOSAL CERTIFICATIONS

Firm Name: _____

Business Address: _____

Telephone Number: _____

Date of Bid: _____

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

II. Non-Collusive Bidding Certification: By submission of this bid proposal, the bidder certifies that he is complying with Section 103-d of the General Municipal Law as follows:

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

"(a) 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 knowledge and belief:

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

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

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

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

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

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

Signature (Authorized) _____

Title _____

HOLD HARMLESS AGREEMENT

Contractor will be required to sign the following "Hold Harmless" Agreement with the Ossining Union Free School District. Compliance with the foregoing requirements for insurance shall not relieve the contractor from liability set forth under the Indemnity Agreement.

The _____
(Name of Company)

hereby agrees to defend, indemnify and save harmless the Ossining Union Free School District from and against any and all liability, loss, damages, claims for bodily injury and/or property damages, cost and expense including counsel fees, to the extent permissible by law, arising out of the services provided for the contractor under the contract including but not limited to the transportation of individuals by the _____
(Name of Company)

its employees, agents, servants, and volunteers.

Date

Contractor/Bidder

Seal - Signature of Authorized Officer
of Corporation, Partnership, etc.

00 49 80 - Insurance Certification Form

Project No.: 66-14-01-03-0-003-040

Name of Project: HS 3rd Floor Connector

Your insurance representative must complete the form below in order to be considered for the award of this bid or project, and it is important that you complete the Bidder's Acknowledgement section of this form. Please note that this Insurance Certification form must accompany your bid submission in order for your bid to be considered.

Insurance Representative's Acknowledgement:

We have reviewed the insurance requirements set forth in the Specification and Section 00 72 50 and are capable of providing such insurance to our insured in accordance with such requirements in the event the contract is awarded to our insured and provided our insured pays the appropriate premium.

Insurance Representative:

Address:

Are you an agent for the companies providing the coverage? Yes____No_____

Date: _____

Insurance Representative Signature

Bidder's Acknowledgement:

I acknowledge that I have received the insurance requirements of this bid and have considered the costs, if any, of procuring the required insurance and will be able to supply the insurance required in accordance with the bid, if it is awarded. I understand that this Insurance Certification form must be submitted with my bid and my inability to provide the required insurances may result in the rejection of my bid, and the Ossining Union Free School District may award the contract to the next lowest/responsive bidder.

Firm name: _____

Address: _____

Date: _____

Bidder's Signature

SECTION 00 5100 AGREEMENT

AGREEMENT made as of the DATE day of MONTH in the year of

BETWEEN the Owner **Ossining Union Free School District**
 400 Executive Boulevard
 Ossining, New York 10562

and the Contractor: Contractor's Name
 Address Line 1
 Address Line 2

The Project is:

The Architect is:
(Name and address)

The Owner and Contractor agree as set forth below.

ARTICLE 1

THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General Conditions, Special Provisions and other Conditions), Drawings, specifications, Addenda issued prior to execution of this Agreement, other documents listed in Article 9 of this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2

THE WORK OF THIS CONTRACT

The Contractor shall execute the entire Work described in the Contract Documents or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3

DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 The date of commencement of the work and substantial completion of the work of this contract shall be in accordance with the schedule set forth in the Project Manual.

3.2 Time is of the essence respecting the contract documents and all obligations thereunder.

3.3 Upon the execution of this Agreement, the Contractor shall provide the Owner with copies of all contracts entered into between the Contractor and subcontractors or material suppliers. The Contractor's obligation to provide the Owner with said contracts shall continue for the duration of the Project.

ARTICLE 4

CONTRACT SUM

4.1 The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of written contract amount , subject to additions and deductions as provided in the Contract Documents.

4.3 Unit prices are as set forth in the proposal sheets.

Insert Unit Prices

ARTICLE 5

PROGRESS PAYMENTS

SECTION 00 52 09 - AGREEMENT

5.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

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

All progress payments shall be based upon an estimate and a certificate, made by the Architect, of the materials furnished, installed and suitably stored at the site and the work done by the Contractor, and payment shall be made in installments of ninety-five percent (95%) of the amount certified as earned so that, at the completion of the work, there will be a retainage of five percent (5%) of the Total Contract Sum. Retainage shall be paid to the Contractor upon final completion of the work of this contract. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

The Contractor shall submit with each application for payment the following:

1. A current Sworn Statement from the Contractor setting forth all subcontractors and materialmen with whom the Contractor has subcontracted, the amount of such subcontract, the amount requested for any subcontractor or materialman in the application for payment and the amount to be paid to the Contractor from such progress payment;
2. Commencing with the second (2nd) Application for Payment submitted by the Contractor, duly executed so-called "after the fact" waivers of mechanics' and materialmen's liens from all subcontractors, materialmen and, when appropriate, from lower tier subcontractors, establishing receipt of payment or satisfaction of payment of all amounts requested on behalf of such entities and disbursed prior to submittal by the Contractor of the current Application for Payment, plus sworn statements from all subcontractors, materialmen and, where appropriate, from lower tier subcontractors, covering all amounts described in this Paragraph 5.2;
3. Such other information, documentation and materials as the Owner or the Architect may require.

5.3 Payment shall not be released to the Contractor until the Owner receives the following documentation:

1. Certified payroll for employees and employees of subcontractors performing work on the Project.
2. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.

ARTICLE 6 **FINAL PAYMENT**

Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed including compliance with all provisions of

the Contract Documents except for the Contractor's responsibility to correct nonconforming Work under Article 15(B) of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows or as soon thereafter as is practicable.

ARTICLE 7
MISCELLANEOUS PROVISIONS

7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

7.2 The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement and the final completion of the Work:

1. that it and its Subcontractors are financially solvent, able to pay all debts as they mature and possessed of sufficient working capital to complete the Work and perform all obligations hereunder;
2. that it is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder;
3. that it is authorized to do business in the State of New York and the United States and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project;
4. that its execution of this Agreement and its performance thereof is within its duly authorized powers;
5. that its duly authorized representative has visited the site of the Project, is familiar with the local and special conditions under which the Work is to be performed and has correlated on-site observations with the requirements of the Contract Documents; and
6. that it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence or projects of the size, complexity and nature of the particular Project, and that it will perform the Work with the care, skill and diligence of such a contractor.

The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance hereunder. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the Work. All representations and warranties set forth in this Agreement, including without limitation, this Paragraph 7.2, shall survive the final completion of the Work or the earlier termination of this Agreement. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

ARTICLE 8
TERMINATION OR SUSPENSION

- 8.1** The Contract may be terminated by the Owner as provided in the General Conditions.
- 8.2** The Work may be suspended by the Owner as provided in the General Conditions.

ARTICLE 9
ENUMERATION OF CONTRACT DOCUMENTS

- 9.1** The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:
- 9.1.1** The Agreement is this executed Agreement between Owner and Contractor.
- 9.1.2** The General Conditions are the General Conditions of the Contract for Construction as set forth in the Project Manual and attached hereto.
- 9.1.3** The Specifications are as set forth in the Project Manual and indexed in table of contents.
- 9.1.4** The Drawings are those as follows:
- Insert Drawing List
- 9.1.5** The Addenda, if any, are as follows:

SECTION 00 52 09 - AGREEMENT

This Agreement is entered into as of the day and year first written above and is executed in at least three original copies of which one is to be delivered to the Contractor, one to the Architect for use in the administration of the Contract, and the remainder to the Owner.

OWNER

Ossining Union Free School District
400 Executive Boulevard
Ossining, New York 10562

By _____
(Signature)

(Printed Name and Title)

CONTRACTOR

To Be Determined
Number and Street Name
City , State Zip Code

By _____
(Signature)

(Printed Name and Title)

SECTION 00 6000 - PROJECT FORMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section lists the project forms used for administration of the project.

1.2 FORMS

- A. The following forms are provided in this Section:
1. FRONT END SUBMITTAL LOG
 2. REQUEST FOR INFORMATION (RFI) FORM
 3. SUBCONTRACTOR LIST
 4. ALLOWANCE DISBURSEMENT AUTHORIZATION FORM
 5. SUBSTITUTION REQUEST FORM
 6. SUBMITTAL COVER
 7. INFORMATION BULLETIN
 8. AIA FORMS (Forms provided are samples. Original AIA Documents shall be used):
 - a. Contractor's Qualification Statement (AIA Document A305).
 - b. Bid Bond (AIA Document A310).
 - c. Performance Bond (AIA Document A312).
 - d. Change Order (AIA Document G701/CMA).
 - e. Application and Certificate for Payment (AIA Document G732) and Continuation Sheet (AIA Document G703).
 - f. Certification of Substantial Completion (AIA Document G704/CMA).
 - g. Contractor's Affidavit of Payment of Debts and Claims (AIA Document G706).
 - h. Contractor's Affidavit of Release of Liens (AIA Document G706A).
 - i. Consent of Surety to Final Payment (AIA Document G707).
 - j. Work Changes Proposal Request (AIA Document G709).
 - k. Architect's Supplemental Instructions (AIA Document G710).
 - l. Construction Change Directive (AIA Document G714).
 - m. Supplemental Attachment for ACORD Certificate of Insurance 25-S (AIA Document G715).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROCEDURES

- A. **Front End Submittal Log:** This document is a checklist of the general condition submittals required. Refer to Bidding Requirements, Section entitled "Instructions to Bidders" and Division 1, Specification Section entitled "SUBMITTAL PROCEDURES" for submission procedures.
- B. **Request For Information (RFI) Form:** This form is to be used for information requests. The forms are filled out by any party to the contract and sent to the Architect/Engineer. The Architect/Engineer shall number RFI before processing.
- C. **Subcontractor List:** This document is to be used identify subcontractors. The forms shall be filled out by each Prime Contractor for all proposed subcontractors and sent to the

Architect/Engineer in accordance with. Division 1, section entitled "SUBMITTAL PROCEDURES"

- D. **Allowance Disbursement Authorization Form:** The Architect/Engineer shall issue this document after all parties have agreed to the conditions of change to be charged to the Allowance Amount in accordance with Division 1, section entitled "ALLOWANCES", if required.
- E. **Substitution Request Form:** This document is to be used by a Contractor to propose substitutions. The forms are filled out by each Prime Contractor and sent to the Architect/Engineer in accordance with. Division 1, Sections entitled "SUBMITTAL PROCEDURES" and "PRODUCT REQUIREMENTS".
- F. **Submittal Cover:** This document is to be used for submittal submissions. The forms are filled out by each Prime Contractor and sent to the Architect/Engineer in accordance with. Division 1, section entitled "SUBMITTAL PROCEDURES"
- G. **Information Bulletin:** The Architect/Engineer shall issue this document for 3 actions:
1. PROPOSAL REQUEST: To request a proposal from the Contractor for changes to the scope of work.
 2. SUPPLEMENTAL INSTRUCTIONS: Instructions for changes to the Contract Documents without additional cost or time.
 3. CONSTRUCTION CHANGE AUTHORIZATION: A directive to immediately proceed with changes to the work of the contract and to submit final cost for inclusion into a Change Order.

END OF SECTION 00 6000



FRONT END SUBMITTAL LOG

**OSSINING UNION FREE SCHOOL DISTRICT
OSSINING HIGH SCHOOL 3RD FLOOR CONNECTOR**

Contractor Name: _____

SUBMISSIONS

Submission	Date		Remarks
	Submitted	Approved	
Contract:			
Schedule of Values:			
Bonds:			
Insurance:			
Workers Compensation:			
Automobile Insurance:			
Safety Program:			
Construction Schedule:			
Submittal Schedule:			
Emergency Contact:			
Substitution List:			
Subcontractor List:			
Project Manager:			
Superintendent:			

This log is to be used by the Contractor to monitor and complete the required front-end submissions.

REQUEST FOR INFORMATION	RFI No:
	Date:

**OSSINING UNION FREE SCHOOL DISTRICT
OSSINING HIGH SCHOOL 3RD FLOOR CONNECTOR**

Contract: _____

To: _____

From: _____

Copies to: _____

WE REQUEST YOUR ATTENTION (OR CONFIRMATION) REGARDING THE FOLLOWING:

(Fully describe the question or type of information requested)

(List specific documents researched when seeking the information requested.)

Specifications: _____ Drawings: _____

Other: _____

Sender's Recommendation: _____

Receiver's Reply: _____

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order or a Construction Change Directive must be executed in accordance with the Contract Documents.

By: _____ Date: _____



Clark Patterson Lee

DESIGN PROFESSIONALS

SUBCONTRACTOR LIST

OSSINING UNION FREE SCHOOL DISTRICT OSSINING HIGH SCHOOL 3RD FLOOR CONNECTOR

To:

Clark Patterson Lee

50 Front Street, Suite 202
Newburgh, New York 12550

From:

(Contractor) _____

Contractors No.: _____

Contract For: _____

List Subcontractors proposed for use on this Project as required by the Construction Documents.
Attach supplemental sheets if necessary.

Section

No.: _____ Section Title: _____

Firm Name: _____ Contact: _____

Address: _____

Section

No.: _____ Section Title: _____

Firm Name: _____ Contact: _____

Address: _____

Section

No.: _____ Section Title: _____

Firm Name: _____ Contact: _____

Address: _____

Section

No.: _____ Section Title: _____

Firm Name: _____ Contact: _____

Address: _____

Section

No.: _____ Section Title: _____

☐ Attachment(s)

Signed by: _____ Date: _____

Copies: ☐ Owner ☐ Consultants ☐ File
☐ ☐ ☐

Allowance Disbursement Authorization

Owner
Construction Manager
Architect
Contractor
Field
Other

Project:

Ossining High School
3rd Floor Connector

Allowance Disbursement No. _____**Initiation Date:** _____**Original Contract For:** _____**Contract Date:** _____**TO CONTRACTOR:**

Name
Address

Description of work to be charged to Contract is as follows:

1. xxxxx.

\$ -
\$ -

Not valid until signed by Owner, Architect, CM (if applicable), and Contractor

The Original Contract Allowance: \$ -

Net Allowance Disbursements previously authorized: \$ -

Contract Allowance prior to this Allowance: \$ -

Charges to Contract Allowance as a result of this authorization \$ -

New Contract Allowance Balance including this authorization \$ -

Owner:

Ossining UFSD
400 Executive Boulevard
Ossining, NY 10562

Architect:

CPL
50 Front Street, Suite 202
Newburgh, NY 12550

Contractor:

Name
Address

Construction Manager:

Name
Address

Name Date

Name Date

Name Date

Name Date



SUBSTITUTION REQUEST FORM

**OSSINING UNION FREE SCHOOL DISTRICT
OSSINING HIGH SCHOOL 3RD FLOOR CONNECTOR**

To: **Clark Patterson Lee** From: _____
50 Front Street, Suite 202 (Contractor) _____
Newburgh, New York 12550 _____

Re: _____ Substitution Request Number: _____

Contract For: _____

Specification Title: _____ Description: _____

Section Number: _____ Page: _____ Part/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached

Reason for not providing specified item: _____

Similar Installation: _____

Project: _____ Architect/Engineer: _____

Contractor: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No
☐ Yes, explain _____

Savings to Owner for accepting substitution: _____ (\$ _____)

Proposed substitution changes Contract Time: ☐ Yes; explain ☐ No ☐ Yes [Add] [Deduct] _____ days

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.

- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By: _____

Signed By: _____

Firm: _____

Address _____

Phone: _____

Attachments: _____

REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed By: _____ Date: _____

Additional

Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ Architect/Engineer

☐ _____

SUBMITTAL COVER SHEET

(Attach to each copy of each submittal)

Clark Patterson Lee

50 Front Street, Suite 202
Newburgh, New York 12550
Phone: (800) 274 - 9000



Clark Patterson Lee
DESIGN PROFESSIONALS

Submittal No. _____

Contractor: _____

Address: _____

Phone / Fax: () _____ () _____

Architect Project No: 14428.13

Contractor's Number: _____

Project Name:
Ossining High School
3rd Floor Connector

TYPE OF SUBMITTAL

(Check one)

☐ Product Data	☐ Color Samples	☐ O&M Manual
☐ Shop Drawings	☐ Product Samples	☐ Record Document
☐ Other		

**DATE RECEIVED BY
ARCHITECT:** _____

**DATE RETURNED TO
CONTRACTOR:** _____

SUBSTITUTION

See General Conditions

- ☐ YES ☐ NO

PRODUCT IDENTIFICATION

Specification Section No: _____

Part/Paragraph: _____

Contract Dwg. Number: _____

Detail Reference: _____

Product: _____

Manufacturer: _____

CONTRACTOR'S APPROVAL

This submittal has been reviewed and approved by the Contractor in accordance with the General Conditions.

By: _____ **Date:** _____

DEVIATION FROM CONTRACT DOCUMENTS:

CONTRACTOR COMMENTS:

FOR USE BY CPL

ARCHITECT/ENGINEER'S STAMP

☐ No Exception Taken	☐ Revise & Resubmit
☐ Furnish as Corrected	☐ Rejected

Corrections or comments made on the submittal during this review do not relieve the Contractor from compliance with the requirements of the Contract Documents. This review is only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

Clark Patterson Lee

Date: _____ By: _____

ARCHITECT/ENGINEER'S COMMENTS:



Clark Patterson Lee
DESIGN PROFESSIONALS

INFORMATION BULLETIN

PROJECT: Ossining Union Free School District INFORMATION BULLETIN NO.: _____
HS 3rd Floor Connector
DATE: _____

OWNER: _____ ARCHITECT'S PROJECT NO.: 14428.13

CONTRACTOR: _____ CONTRACT NO.: _____

CONTRACT DATE: _____

DESCRIPTION:

ATTACHMENT(S): _____

ACTION

- ☐ 1. **PROPOSAL REQUEST:** Submit an itemized quotation for changes in the Contract Sum and/or time required to implement the above proposed modifications to the Contract Documents. This is not authorization to proceed with the work.
- ☐ 2. **SUPPLEMENTAL INSTRUCTIONS:** Implement the above instructions without change to the Contract Sum and/or Time. Prior to proceeding, indicate acceptance below and return one copy to the Architect.
- ☐ 3. **CONSTRUCTION CHANGE AUTHORIZATION:** Proceed with the above described changes to the Contract Documents immediately. Submit final costs and/or change in Contract Time for inclusion in a subsequent Change Order.

Methods: ☐ Lump Sum ☐ Unit Price ☐ Time & Material Not-to-Exceed

Change in Contract Sum of _____

Change in Contract Time of _____ days

ISSUED:

ACCEPTED:

AUTHORIZED:

BY: _____

BY: _____

BY: _____

Architect Date
Required for Actions 1,2,3

Owner Date
Required for Action 3

Contractor Date
Required for Actions 2,3

☐ Owner
☐ Contractor

☐ Architect
☐ Field

☐ Structural
☐ Mechanical/Electrical

☐ Civil
☐ Other (Roofing)



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):

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

- ☐ General Construction
- ☐ HVAC
- ☐ Electrical
- ☐ Plumbing
- ☐ Other (please 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:

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.

- § 1.3.2 State of incorporation:
- § 1.3.3 President's name:
- § 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.)

§ 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;

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-subsiary).

§ 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 20

Notary Public:

My Commission Expires:



AIA® Document A310™ – 1970

Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we
(Here insert full name and address or legal title of Contractor)

as Principal, hereinafter called the Principal, and
(Here insert full name and address or legal title of Surety)

a corporation duly organized under the laws of the State of _____ as Surety, hereinafter
called the Surety, are held and firmly bound unto
(Here insert full name and address or legal title of Owner)

as Oblige, hereinafter called the Oblige, in the sum of (\$ _____), for the payment of
which sum well and truly to be made, the said Principal and the said Surety, bind
ourselves, our heirs, executors, administrators, successors and assigns, jointly and
severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for
(Here insert full name, address and description of project)

NOW, THEREFORE, if the Oblige shall accept the bid of the Principal and the
Principal shall enter into a Contract with the Oblige in accordance with the terms of
such bid, and give such bond or bonds as may be specified in the bidding or Contract
Documents with good and sufficient surety for the faithful performance of such Contract
and for the prompt payment of labor and material furnished in the prosecution thereof, or
in the event of the failure of the Principal to enter such Contract and give such bond or
bonds, if the Principal shall pay to the Oblige the difference not to exceed the penalty
hereof between the amount specified in said bid and such larger amount for which the
Oblige 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.

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.

Signed and sealed this day of ,

_____	_____
(Witness)	(Principal) (Seal)
_____	_____
(Witness)	(Title)
_____	_____
(Witness)	(Surety)
_____	_____
	(Title) (Seal)

**AIA®****Document A312™ – 1984****Performance Bond****CONTRACTOR** (*Name and Address*):**SURETY** (*Name and Principal Place of Business*):**OWNER** (*Name 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 Last Page**CONTRACTOR AS PRINCIPAL**

Company: (Corporate Seal)

Signature:

Name and

Title:

*(Any additional signatures appear on the last page)***SURETY**

Company: (Corporate Seal)

Signature:

Name and

Title:

*(FOR INFORMATION ONLY - Name, Address and Telephone)***AGENT or BROKER:****OWNER'S REPRESENTATIVE***(Architect, Engineer or other party):***ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contract, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and the 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 to participate in conferences as provided in Section 3.1.

§ 3 If there is no Owner Default, the Surety's obligation under this Bond shall arise after:

§ 3.1 The Owner has notified the Contractor and the Surety at its address described in Section 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. 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; and

§ 3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Section 3.1; and

§ 3.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the Owner.

§ 4 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:

§ 4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Construction Contract; or

§ 4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; or

§ 4.3 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 the 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 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

§ 4.4 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, tender payment therefor to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

§ 5 If the Surety does not proceed as provided in Section 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen 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 4.4, and the Owner refuses the payment tendered 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.

§ 6 After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Section 4.1, 4.2, or 4.3 above, 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. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:

§ 6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

§ 6.2 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 4; and

§ 6.3 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.

§ 7 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 or successors.

§ 8 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.

§ 9 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 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.

§ 10 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.

§ 11 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 here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 12 DEFINITIONS

§ 12.1 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.

§ 12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

§ 12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

§ 12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

§ 13 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____
(Corporate Seal)

SURETY

Company: _____
(Corporate Seal)

Signature: _____
Name and Title:
Address:

Signature: _____
Name and Title:
Address:

Payment Bond

CONTRACTOR *(Name and Address):*

SURETY *(Name and Principal Place of Business):*

OWNER *(Name 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 Last Page

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and Title:

(Any additional signatures appear on the last page)

Signature: _____

Name and Title:

(FOR INFORMATION ONLY - Name, Address and Telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE *(Architect, Engineer or other party):*

§ 1 The Contractor and the 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.

§ 2 With respect to the Owner, this obligation shall be null and void if the Contractor:

§ 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

§ 2.2 Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for the payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Section 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

§ 3 With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

§ 4 The Surety shall have no obligation to Claimants under this Bond until:

§ 4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Section 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

§ 4.2 Claimants who do not have a direct contract with the Contractor:

- .1 Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
- .2 Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and
- .3 Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Section 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

§ 5 If a notice required by Section 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

§ 6 When the Claimant has satisfied the conditions of Section 4, the Surety shall promptly and at the Surety's expense take the following actions:

§ 6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

§ 6.2 Pay or arrange for payment of any undisputed amounts.

§ 7 The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 8 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 the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 9 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 payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

§ 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 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Section 4.1 or Section 4.2.3, 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.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

§ 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. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 15 DEFINITIONS

§ 15.1 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 Contract. 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.

§ 15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

§ 15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

§ 16 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____



AIA® Document G701/CMa™ – 1992

Change Order - Construction Manager-Adviser Edition

PROJECT <i>(Name and address):</i>	CHANGE ORDER NUMBER:	OWNER: ☐
	INITIATION DATE:	CONSTRUCTION MANAGER: ☐
		ARCHITECT: ☐
TO CONTRACTOR <i>(Name and address):</i>	PROJECT NUMBERS: /	CONTRACTOR: ☐
	CONTRACT DATE:	FIELD: ☐
	CONTRACT FOR:	OTHER: ☐

THE CONTRACT IS CHANGED AS FOLLOWS:

The original Contract Sum was	\$	0
Net change by previously authorized Change Orders	\$	0.00
The Contract Sum prior to this Change Order was	\$	0.00
The Contract Sum will be increased by this Change Order in the amount of	\$	0.00
The new Contract Sum including this Change Order will be	\$	0.00

The Contract Time will be increased by Zero (0) days.
The date of Substantial Completion as of the date of this Change Order therefore is .

NOTE: This summary does not reflect changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE OWNER, CONSTRUCTION MANAGER, ARCHITECT AND CONTRACTOR.

CONSTRUCTION MANAGER <i>(Firm name)</i>	ARCHITECT <i>(Firm name)</i>
ADDRESS	ADDRESS
BY <i>(Signature)</i>	BY <i>(Signature)</i>
<i>(Typed name)</i> DATE:	<i>(Typed name)</i> DATE:
CONTRACTOR <i>(Firm name)</i>	OWNER <i>(Firm name)</i>
ADDRESS	ADDRESS
BY <i>(Signature)</i>	BY <i>(Signature)</i>
<i>(Typed name)</i> DATE:	<i>(Typed name)</i> DATE:



AIA Document G732™ - 2009

Application and Certificate for Payment, Construction Manager as Adviser Edition

TO OWNER:	PROJECT:	APPLICATION NO: 001	Distribution to:
FROM	VIA CONSTRUCTION	PERIOD TO:	OWNER: ☐
CONTRACTOR:	MANAGER:	CONTRACT DATE:	CONSTRUCTION MANAGER: ☐
CONTRACT FOR:	VIA ARCHITECT: CPL	PROJECT NOS: /	ARCHITECT: ☐
			CONTRACTOR: ☐
			FIELD: ☐
			OTHER: ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM \$0.00 CONTRACTOR:
2. NET CHANGE BY CHANGE ORDERS \$0.00 By: Date:
3. CONTRACT SUM TO DATE (Line 1 ± 2) \$0.00 State of: County of:
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) \$0.00

5. RETAINAGE:

- a. 0 % of Completed Work (Column D + E on G703) \$0.00
- b. 0 % of Stored Material (Column F on G703) \$0.00

Total Retainage (Lines 5a + 5b or Total in Column I of G703) \$0.00

6. TOTAL EARNED LESS RETAINAGE

(Line 4 Less Line 5 Total) \$0.00

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT

(Line 6 from prior Certificate) \$0.00

8. CURRENT PAYMENT DUE

(Line 6 from prior Certificate) \$0.00

9. BALANCE TO FINISH, INCLUDING RETAINAGE

(Line 3 less Line 6) \$0.00

CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on evaluations of the Work and the data comprising this application, the Construction Manager and Architect certify to the Owner that to the best of their knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

CONSTRUCTION MANAGER:

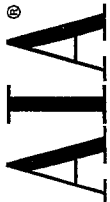
By: _____ Date: _____

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$0.00	\$0.00
Total approved this month including Construction Change Directives	\$0.00	\$0.00
TOTALS	\$0.00	\$0.00
NET CHANGES IN THE WORK		\$0.00



Document G703™ - 1992

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

containing Contractor's signed certification is attached. In tabulations below, amounts are stated to the nearest dollar.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G	H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
							% (G ÷ C)	
	GRAND TOTAL						%	

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User Notes:

(2811165891)



AIA® Document G704/CMa™ – 1992

Certificate of Substantial Completion Construction Manager-Adviser Edition

PROJECT:
(Name and address)

PROJECT NUMBER: /
CONTRACT FOR:
CONTRACT DATE:

OWNER: ☐

CONSTRUCTION MANAGER: ☐

ARCHITECT: ☐

TO OWNER:
(Name and address)

TO CONTRACTOR:
(Name and address)

CONTRACTOR: ☐

FIELD: ☐

OTHER: ☐

DATE OF ISSUANCE:

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Construction Manager's and Architect's best knowledge, information and belief, to be substantially complete. 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. The date of Substantial Completion of the Project or portion thereof designated above is hereby established as which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

Warranty

Date of Commencement

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

CONSTRUCTION MANAGER	BY	DATE

ARCHITECT	BY	DATE

The Contractor will complete or correct the Work on the list of items attached hereto within _____ days from the above date of Substantial Completion.

CONTRACTOR	BY	DATE

The Owner accepts the Work or designated portion thereof as substantially complete and will assume full possession thereof at _____ (time) on _____ (date).

OWNER	BY	DATE

The responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:

(Note—Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)



AIA[®] Document G706[™] – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

CONTRACT FOR:

TO OWNER: *(Name and address)*

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☐ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:



AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR:	CONTRACTOR: ☐
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	SURETY: ☐
		OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐

ARCHITECT: ☐

CONTRACT FOR:

CONTRACTOR: ☐

TO OWNER: *(Name and address)*

CONTRACT DATED:

SURETY: ☐

OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of

(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the
Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:

(Seal):



AIA® Document G709™ – 2001

Work Changes Proposal Request

PROJECT (Name and address):

PROPOSAL REQUEST NUMBER:

OWNER: ☐

ARCHITECT: ☐

DATE OF ISSUANCE:

CONSULTANT: ☐

CONTRACTOR: ☐

OWNER (Name and address):

CONTRACT FOR:

FIELD: ☐

OTHER: ☐

CONTRACT DATE:

FROM ARCHITECT (Name and address):

ARCHITECT'S PROJECT NUMBER:

TO CONTRACTOR (Name and address):

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Within () days, the Contractor must submit this proposal or notify the Architect, in writing, of the date on which proposal submission is anticipated.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

DESCRIPTION (Insert a written description of the Work):

ATTACHMENTS (List attached documents that support description):

REQUESTED BY THE ARCHITECT:

(Signature)

(Printed name and title)



AIA® Document G710™ – 2017

Architect's Supplemental Instructions

PROJECT: *(name and address)*

CONTRACT INFORMATION:

Contract For:

Date:

ASI INFORMATION:

ASI Number: 001

Date:

OWNER: *(name and address)*

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE



AIA[®] Document G714[™] – 2017

Construction Change Directive

PROJECT: *(name and address)*

CONTRACT INFORMATION:

Contract For:

Date:

CCD INFORMATION:

Directive Number: 001

Date:

OWNER: *(name and address)*

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Contractor is hereby directed to make the following change(s) in this Contract:

(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits.)

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

☒ Lump Sum decrease of \$0.00

☐ Unit Price of \$ per

☐ Cost, as defined below, plus the following fee:

(Insert a definition of, or method for determining, cost)

☐ As follows:

2. The Contract Time is proposed to remain unchanged. The proposed adjustment, if any, is (0 days).

NOTE: *The Owner, Architect and Contractor should execute a Change Order to supersede this Construction Change Directive to the extent they agree upon adjustments to the Contract Sum, Contract Time, or Guaranteed Maximum price for the change(s) described herein.*

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

ARCHITECT *(Firm name)*

OWNER *(Firm name)*

CONTRACTOR *(Firm name)*

SIGNATURE

SIGNATURE

SIGNATURE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

DATE

DATE

DATE



AIA® Document G715™ – 2017

Supplemental Attachment for ACORD Certificate of Insurance 25

PROJECT: (name and address)	CONTRACT INFORMATION: Contract For: Date:	CERTIFICATE INFORMATION: Producer: Insured: Date:
OWNER: (name and address)	ARCHITECT: (name and address)	CONTRACTOR: (name and address)

A. General Liability		Yes	No	N/A
1.	Does this policy include coverage for:			
a	Damages because of bodily injury, sickness, or disease, including occupational sickness or disease, and death of any person?	☐	☐	☐
b	Personal injury and advertising injury?	☐	☐	☐
c	Damages because of physical damage to or destruction of tangible property, including the loss of use of such property?	☐	☐	☐
d	Bodily injury or property damage arising out of completed operations?	☐	☐	☐
e	The Contractor's indemnity obligations included in the Contract Documents?	☐	☐	☐
2.	Does this policy contain an exclusion or restriction of coverage for:			
a	Claims by one insured against another insured, where the exclusion or restrictions is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim?	☐	☐	☐
b	Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor?	☐	☐	☐
c	Claims for bodily injury other than to employees of the insured?	☐	☐	☐
d	Claims for the Contractor's indemnity obligations included in the Contract Documents arising out of injury to employees of the insured?	☐	☐	☐
e	Claims for loss excluded under a prior work endorsement or other similar exclusionary language?	☐	☐	☐
f	Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language?	☐	☐	☐
g	Claims related to residential, multi-family, or other habitational projects?	☐	☐	☐
h	Claims related to roofing?	☐	☐	☐
i	Claims related to exterior insulation finish systems, synthetic stucco, or similar exterior coatings or surfaces?	☐	☐	☐
j	Claims related to earth subsistence or movement?	☐	☐	☐
k	Claims related to explosion, collapse, and underground hazards?	☐	☐	☐
B. Other Insurance Coverage		Yes	No	N/A
1.	Indicate whether the Contractor has the following insurance coverages and, if so, indicate the coverage limits for each.			
a	Professional liability insurance Coverage limits:	☐	☐	☐
b	Pollution liability insurance Coverage limits:	☐	☐	☐
c	Insurance for maritime liability risks associated with the operation of a vessel Coverage limits:	☐	☐	☐

d	Insurance for the use or operation of manned or unmanned aircraft	☐	☐	☐
	Coverage limits:			
e	Property insurance	☐	☐	☐
	Coverage limits:			
f	Railroad protective liability insurance	☐	☐	☐
	Coverage limits:			
g	Asbestos abatement liability insurance	☐	☐	☐
	Coverage limits:			
h	Insurance for physical damage to property while it is in storage and in transit to the construction site	☐	☐	☐
	Coverage limits:			
i	Other:	☐	☐	☐

(Authorized Representative)

(Date of Issue)

SECTION 00 7100 – GENERAL CONDITIONS**PART 1 - GENERAL****1.1 SUMMARY**

- A. The “General Conditions of the Contract for Construction” is bound with this Section. It sets forth the rights, responsibilities, and relationships of the Owner, Contractor, and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 7100

GENERAL CONDITIONS

of the

CONTRACT for CONSTRUCTION

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GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The within document includes detailed provisions concerning the capital improvement work to be performed by the Contractors engaged by the School District. This document contains provisions which relate particularly to capital improvement projects in the school district setting in New York State. The document is incorporated by reference into all contracts to be awarded and should be reviewed carefully by the Contractor to whom the award of contract is made. Consultation with an attorney and insurance representative is advised.

ARTICLE 1 DEFINITIONS

- A. "Addendum" or "Addenda" refers to revised drawings and/or written requirements for the capital improvement work issued by the Architect prior to the time indicated for submission of a bid by a contractor.
- B. "After Hours" refers to the time before or after the hours school is in session. During this time, students and staff may occupy portions of the facility or building, but may be redirected as required to allow for the completion of work by a contractor.
- C. The "Architect" is the design professional engaged by the School District to perform design related functions respecting the capital improvement projects to be performed in the School District.
- D. "Board of Education" refers to the Board of Education of the School District.
- E. "Central Administration" refers to the Superintendent of Schools, his/her Assistant Superintendents, and Director of Plant & Facilities.
- F. The "Construction Manager" is the entity engaged by the School District to act as its representative during the course of construction of the Project.
- G. "Contract Documents" refers to all drawings, sketches, specifications, addenda, field directives and all other written or drawn descriptions of the products, labor and materials to be provided for the Project.
- H. The "Contractor" refers to the entity engaged by the School District to perform all or a part of the capital improvement project on its behalf.
- I. The "Drawings" are the plans, elevations, sections, details, schedules and diagrams developed by the Architect for the capital improvement projects to be performed in accordance with the project manual of which these General Conditions of the Contract for Construction form a part.

J. The "Off Hours" refers to a period of time during which the school facility or building shall be unoccupied, to be a duration of no less than 24 hours.

K. The "Owner" refers to the Board of Education or its designee.

L. The "Project" refers to the entire capital improvement project to be performed in accordance with the project manual and may include work by the Owner.

M. The "Project Manual" is the bound document which is issued simultaneously with the project Drawings and includes the Notice to Bidders, Information to Bidders, Bid Proposal Form, Prevailing Wage Rate schedule and the written requirements for labor, materials, equipment, construction systems and the like necessary for the Contractor to complete the capital improvement work for which it has been engaged.

N. A "Subcontractor" is a person or entity who has a direct contract with the Contractor to provide material and/or labor for the project on or off the site, or to otherwise furnish labor, material or other services with respect to a portion of the Contractor's work. A "Sub-subcontractor" is a person or entity who has a direct or indirect contract with a Subcontractor engaged by the Contractor to perform a portion of the Subcontractor's work at the site, or to otherwise furnish labor, material or other services with respect to a portion of the Subcontractor's work.

O. The term "Specialist" or "Specialty Contractor" as used in these specifications shall mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workers skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

P. "Accepted", "directed" "permitted," "requested," "required," and "selected" mean, unless otherwise explained, "accepted by the Architect and/or Owner" "directed by the Architect and/or Owner," "permitted by the Architect and/or Owner," "requested by the Architect and/or Owner," "required by the Architect and/or Owner," and "selected by the Architect and/or Owner." However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.

Q. "As accepted" "or acceptable substitute", and "for review" mean the Architect is the sole judge of the quality and suitability of the proposed substitutions. Where used in conjunction with the Architect's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the meaning will be held to the limitations of the Architect's responsibilities and duties as stated in the General Conditions. In no case will "accepted by the Architect" be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

R. “Furnish” means supply and deliver to the Project site or other designated location, ready for unloading, unpacking, storing, assembly, installation, application, erection, or other form of incorporation into the Project, and maintained ready for use. Supply and deliver products requiring additional or supplemental fitting, assembly, fabrication, or incorporation into other elements of the Project directly to the fabricator, installer or manufacturer as required.

S. “Install” means unload, unpack, use, fit, attach, assemble, apply, place, anchor, erect, finish, cure, protect, clean, and similar operations required to properly incorporate work into the Project.

T. “Provide” means furnish and install.

U. “Replace” means remove designated, damaged, rejected, defective, unacceptable, or non-conforming work from the Project and provide new work meeting the requirements of the Contract Documents in place thereof.

V. “Unusual” refers to means and methods beyond any conventional or generally accepted standard of work or installation, generally requiring a standard of care and protection as outlined by a manufacturer’s guidelines and recommendations.

W. The word “include”, in any form other than “inclusive”, is non-limiting and is not intended to mean 'all-inclusive'.

ARTICLE 2 CONTRACTOR’S REPRESENTATIONS

A. Upon submission of its bid to the Owner, the Contractor expressly represents:

1. The Contractor represents and warrants that it performed a detailed investigation of the site(s) and that such investigation was sufficient to disclose the conditions of the site(s) at which work is to be performed by it and all improvements thereon, and the conditions under which the work is to be performed, including, but not limited to (a) the location, condition, layout and nature of the project site and surrounding areas; (b) the cost of labor, materials and equipment necessary to perform the work, the availability; (c) the areas of the work which will cause a disruption to the necessary and proper operation of the facilities by the Owner; and (d) other pertinent limitations on the performance of its work.

2. The Contractor represents and warrants that it has carefully studied and compared the drawings and pertinent provisions of the project manual and that any errors, omissions, ambiguities, discrepancies or conflicts found in said documents have been brought to the attention of the Architect for clarification prior to the Contractor’s

submission of its bid. If, in the interpretation of Contract Documents, requirements within the Drawings and Specifications conflict, or it appears that the Drawings and Specifications are not in agreement, the requirement to be followed shall be decided by the Architect. Where there is a discrepancy in quantity, the Contractor shall provide the greater quantity; where there is a discrepancy in quality, the Contractor shall provide the superior quality. Addenda supersede the provisions that they amend.

3. Each trade contractor certifies to be experienced and familiar with the requirements and conditions imposed during the construction of similar work in the area. This includes, but is not limited to, the requirement of normal "out of sequence" or "come back" work for the removal of plant, equipment, temporary wiring or plumbing, etc. This "out of sequence" work may also include phasing of construction activities to accommodate the installation of the work at various locations and orderly fashion and the completion of work at various locations and/or levels at various times. This "phasing", "out of sequence", or "come back" work shall be done at no cost to other trade contractors, the Owner, Architect or the Construction Manager.

B. The Contractor warrants to the Owner that (1) the materials and equipment furnished under its contract will be of good quality and new, and of recent manufacture, unless otherwise required or permitted by the Contract Documents, (2) that its work will be free from defects not inherent in the quality required or permitted, and (3) that its work will conform with the terms and conditions of its agreement with the Owner. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective and shall be removed and replaced at the Contractor's cost and expense. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

C. Except as to any reported errors, inconsistencies or omissions, and to concealed or unknown conditions, by executing the Agreement, the Contractor represents the following:

1. The drawings and accompanying specifications found in the project manual issued simultaneously with said drawings are sufficiently complete and detailed for the Contractor to (a) perform the work required to produce the results intended by the Owner and (b) comply with all the requirements of its contract with the Owner.

2. The work required to be performed by the contractor including, without limitation, all construction details, construction means, methods, procedures and techniques necessary to perform its work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (a) good and prevailing and accepted industry standards applicable to its work; (b) requirements of any warranties applicable to its work; and (c) all laws, ordinances, regulations, rules and orders which bear upon the Contractor's performance of its work.

3. The Drawings and Specifications for the Contract have been prepared with

care and are intended to show as clearly as is practicable the work required to be done. Work under all items in the Contract must be carried out to meet field conditions to the satisfaction of the Architect and Owner and in accordance with his instructions and the Contract Drawings and Specifications.

4. All dimensions shown on the Drawings are for bidding purposes only. It is the responsibility of the Contractor to verify all dimensions in the field to insure proper and accurate fit of materials and items to be installed.

D. The representations set forth herein shall survive expiration and/or termination of the Contractor's agreement with the Owner.

ARTICLE 3 CONTRACTOR'S CONSTRUCTION PROCEDURES

A. 1. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures required for the proper execution of its work on the project. Where the drawings and/or project manual make reference to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in connection with the Contractor's work, such reference is intended only to indicate that the Contractor's work is to produce at least the quality of the work implied by the operations described, but the actual determination as to whether or not the described operations may be safely or suitably employed in the performance of the Contractor's work shall be the sole responsibility of the Contractor. All loss, damage, liability, or cost of correcting defective work arising from the employment of a specific construction means, method, technique, sequence or procedure shall be borne solely by the Contractor.

2. Neither the Architect nor the Owner will have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided herein.

3. The Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, rigging, water, heat, utilities, light, transportation, and other facilities and services necessary for proper execution and completion of its work, whether temporary or permanent and whether or not incorporated or to be incorporated in its work.

B. The Contractor shall be responsible for coordinating the work of its own forces and the work of subcontractors engaged by it to perform the work of the project on its behalf. The Contractor shall supply to its own work forces and subcontractors engaged by it to perform portions of its work copies of the drawings and project manuals for the work to be performed by such individuals/entities on its behalf. The Contractor shall review any

specified or installation procedure with its employees and/or subcontractors, including those recommended by any product manufacturer, prior to the commencement of the relevant portion of the work to be performed. The Contractor shall be responsible to the Owner for the acts and/or omissions of the Contractor's employees, the Contractor's Subcontractors, the Contractor's material suppliers, and/or their respective agents and employees, and any other persons performing portions of the work on behalf of the Contractor.

C. The Contractor shall be responsible for the inspection of portions of the project performed by its own work force and/or subcontractors engaged by it for the purpose of determining that said work is in proper condition to receive subsequent work.

D. The Contractor shall perform its work in accordance with the standards of the construction industry applicable to work in the locale in which work is to be performed.

E. The Contractor shall only employ labor on the project or in connection with its work capable of working harmoniously with all trades, crafts and any other individuals associated with the capital improvement work to be performed. There shall be no strikes, picketing, work stoppages, slowdowns or other disruptive activity at the project for any reason by anyone employed or engaged by the Contractor to perform its portion of the work. There shall be no lockout at the project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the work under any circumstance. Should it become necessary to create a separate entrance for a contractor involved in a labor dispute, all costs associated with creating that entrance shall be borne by the contractor involved in the dispute. Such costs shall include, but not be limited to, signage, fencing, temporary roads and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.

F. 1. If the Contractor has engaged the services of workers and/or subcontractors who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect or the Owner, any conflict between its agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.

2. In case the progress of the capital improvement work to be performed by the Contractor is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to its agreement with the Owner because of a conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive but in no case shall the amount of such change be charged by the Contractor to the Owner as an additional cost to perform the capital improvement work pursuant to its contract.

3. The Contractor shall ensure that its work continues uninterrupted during the pendency of a labor dispute.

4. The Contractor shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes.

G. The Contractor shall enforce strict discipline and good order among the Contractor's employees and its Subcontractors' work forces and other persons carrying out the performance of its work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Owner reserves the right to object to any person to be hired or who is employed by the Contractor. Upon the request of the Owner, said person shall be removed from the Project and not again be assigned to perform the Contractor's work without the written permission of the Owner.

H. Within one (1) week after a Notice to Proceed is received, the Contractor shall employ a competent, full-time Project Manager and On Site Superintendent to be approved by the Owner or its representative, and such necessary assistants who shall be in attendance at each project site whenever and wherever work is in progress to provide for the expeditious completion of the work. Said Project Manager and On Site Superintendent shall be employed until punchlist and closeout of the Project. To the extent work is being performed contemporaneously at different facilities within the School District, the Contractor shall assign different superintendents for each facility at which work is being performed. The Project Manager and On Site Superintendent assigned by the Contractor shall not be changed except with the consent of Owner, unless the Project Manager or On Site superintendent or such assistant proves to be unsatisfactory to the Contractor and/or ceases to be in its employ. The Project Manager and On Site Superintendent shall represent the Contractor, and communications given to the Project Manager or On Site Superintendent, whether verbal or written, shall be as binding as if given to the Contractor. Oral communications to the superintendent(s) or his/her assistant(s) and/or project manager shall be confirmed in writing by the Owner, or Architect. The Contractor shall forward to the Owner a copy of the resumes for each of its superintendents, project managers and their assistants. The Owner or the Architect shall have the right to have any supervisory or management staff removed from the project with or without cause.

I. Each Contractor shall provide, or otherwise see that, the project manager, or on site superintendent site managers, and/or responsible workers of each Contractor and major subcontractor are equipped with cellular phones and radios. Each Contractor shall provide the Owner and the Architect with the number for each phone and worker.

J. The Contractor's supervisory personnel, including superintendents and their assistants, shall be versed in the English language. In the event the Contractor's supervisory personnel, superintendents and/or their assistants are not versed in the English language, the Contractor shall employ the services of a full-time on-site interpreter

to facilitate communications with such supervisory personnel, superintendents and/or assistants.

K Prior to the commencement of work, the Contractor shall provide the Construction Manager and the Architect with:

1. a written list of the names, addresses and telephone numbers of the members of its organization who can be contacted in the event of an off-hours emergency at the building site, including cellular telephone numbers and personal/home telephone numbers.
2. a written list of subcontractors, sub-subcontractors, suppliers and vendors with names, addresses, telephone numbers, and descriptions of the work they shall perform or furnish.
3. The name, address and telephone number of the bonding company, banking and insurance company for the Prime Contractor employed by the Prime Contractor including the name, address and telephone number of each bonding company's primary contact representative for this project.
4. Detailed subcontractor schedules indicating the approximate quantity of shop drawings, sequence, timing and man loading.
5. A cash flow projection for the life of the project, including a schedule and graph showing the amount of work projected to be completed each month or billing period and a dollar value for the anticipated billings each month or billing period. This shall be completed after an agreed upon schedule of values has been approved by the Construction Manager.

L. 1. Tests, inspections and approvals of portions of the Contractor's work required by the drawings and/or specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to the Contract Documents and, after consulting with the Architect and Construction Manager, the Construction Manager shall advise the Owner to make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority. The Owner shall bear all costs associated with the tests, inspections or approvals required by the drawings and/or specifications except as set forth in subparagraph 3 hereof.

2. Tests, inspections and approval of portions of the Contractor's work required by laws, ordinances, rules, regulations or orders of public authorities or governmental agency having jurisdiction shall be made at an appropriate time. The Contractor shall consult with

the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to law, ordinance, regulation or orders of public authorities or governmental agencies and shall advise the Owner in writing that it has made arrangements for such tests, inspections and approvals with the appropriate public authority or governmental agency. The Contractor shall be solely responsible for making timely notice of the need for a test, inspection and/or approval with the relevant public authority or governmental agencies and shall bear all costs associated with such testing, inspection or approval required by such public authority or governmental agency.

3. If the Architect, the Construction Manager, the Owner, or public authorities or governmental agencies having jurisdiction determine that portions of the Contractor's work require additional testing, inspection or approval due to the Contractor's failure to perform its work in accordance with the requirements of the Contract Documents and/or laws, ordinances, rules, regulations or orders of public authorities or governmental agencies having jurisdiction, the Architect and the Construction Manager will advise the Owner of the need for such additional inspections or tests and the Owner shall make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner. The Contractor shall bear the costs of such additional testing as provided in Article 14.

M. The Contractor shall, if required by ordinances, laws, codes, rules and/or regulations of the governing agencies having jurisdiction over this project, retain a licensed professional engineer to supervise the construction of this project including, but not limited to, foundations, structural work, soils, welding, reinforced masonry and the like.

N. The Contractor recognizes and acknowledges that the within project is governed by and subject to the provisions of New York State General Municipal Law, section 101, governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other contractors will be performing work on the project in conjunction with it. As such the Contractor agrees to cooperate with such other contractors performing work on the project and shall perform its work as follows:

1. The Contractor shall not interfere with the erection, installation or storage upon the premises of any work, materials, supplies or equipment which is to be performed and furnished by other contractors, and the Contractor shall properly connect and coordinate its work therewith.

2. The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other contractor performing work on the project. If the Contractor sustains any damage through any act or omission of other contractors having a contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a subcontractor of such contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage.

3. The Contractor agrees to defend and indemnify Owner, Architect, Construction Manager, Consultants and Sub-consultants, from all claims made against any of them arising out of Contractor's acts or omissions **or** the acts or omissions of any subcontractor of the Contractor which have caused damage to the Owner, Architect, Construction Manager or other contractor(s) on the project. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, or by the exercise of any other remedy provided for by the contract or by law. Further, the Owner shall withhold from an offending contractor's contract sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

4. When the work of the Contractor or its subcontractors overlap or dovetail with that of other Contractors, materials shall be delivered and operations conducted to carry on the work continuously, in an efficient, workmanlike manner.

5. In case of interference between the operations of different Contractors, the Construction Manager will be the sole judge of the rights of each Contractor and shall have the authority to decide in what manner the work may proceed, and in all cases its decision shall be final. Any decision as to the method and times of conducting the work or the use of space as required in this paragraph shall not be basis of any claim for delay or damages by the Contractor.

6. The Contractor, including its subcontractors, shall keep itself informed of the progress of other contractors and shall notify the Architect or Owner's Representative immediately in writing of lack of progress on the part of other contractors where such delay will interfere with its own operations. Failure of the Contractor to keep informed of the work progressing on the project and failure to give notice of lack of progress by others shall be construed as acceptance by the Contractor of the status of the work as being satisfactory for proper coordination with the Contractor's own work.

7. Delays or oversights on the part of any contractor or subcontractor in getting any or all of their work done in the proper way, thereby causing cutting, removing and replacing work already in place, shall not be the basis for a claim for extra compensation.

8. If part of the Contractor's work depends for proper execution or results upon construction or operations by the Owner or another contractor, the Contractor shall, prior to proceeding with that portion of its work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or other contractor's completed or partially completed construction is fit and proper to receive the Contractor's work.

9. The Contractor shall promptly correct discrepancies or defects in its work which have been identified by other contractors as affecting proper execution and results of the work of such other Contractor.

O. 1. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities or governmental agencies bearing on performance of the Work. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (a) the Owner, its consultants, employees, officers and agents, (b) the Architect and its consultants, employees, officers and agents, and/or (c) the Construction Manager and its consultants, employees, officers and agents against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder.

2. The Contractor shall pay any costs or fees incurred and any fines or penalties imposed as a result of any violation, including any costs or fees incurred by the Owner due to such violation. If the Contractor observes any discrepancies between portions of the Contract Documents, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification to the drawings and/or specifications.

3. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs and shall bear the total cost for correction of same.

4. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation.

P. The Contractor recognizes and acknowledges that job meetings will be held at the job site weekly unless otherwise designated by the Owner or the Architect. The Contractor shall have responsible representation at the MANDATORY weekly job meetings held at the Construction Manager's job office. These meetings will be held to arrange for satisfactory coordination of all trades on the project so as not to impede job progress. Contractors or subcontractors failing to attend job meetings shall be responsible for delays and/or expenses incurred due to coordination difficulty.

Q. The Contractor shall provide copies of its daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00 am the following workday. The daily reports shall provide detailed information concerning the Contractor's activities and operations, including work activities on site and manpower. A "Daily Construction" form is included in these specifications and shall be

used for reporting these activities. In addition, the Contractors are to submit a Two Week Look Ahead schedule for upcoming work. A "Two Week Look Ahead" form is included in these specifications for the Contractor's use.

ARTICLE 4 CONTRACTOR'S USE OF SITE

A. The Contractor shall confine operations at the site to the areas at which construction is to be performed and to such areas permitted by law, ordinances, permits and as set forth in detail in the project manual and drawings forming a part of its contract with the Owner.

B. Five (5) days after receipt of the Notice to Proceed, the Contractor shall provide two (2) copies of a videotaped recording of all existing conditions to the Construction Manager. This taping shall provide a record of all existing buildings, grounds, exterior conditions and interior conditions. The Contractor shall schedule a representative of both the Owner and the Construction Manager to be present at this taping. In the absence of this record, the Contractor shall be responsible for paying the costs associated with any and all repairs in an area where the Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.

C. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

D. General Safety and Security Standards for Construction Projects:

1. All construction materials shall be stored in a safe and secure manner.
2. Fences around construction supplies or debris shall be maintained.
3. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
4. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
5. The Contractor shall exert utmost care and diligence when working in or near any existing buildings or sitework. The absence of protection around such items shall not excuse the Contractor from its liability to provide protection. Any damage to existing buildings, sitework or facilities shall be repaired and charged to the Contractor responsible for the damage.
6. The Contractor shall be responsible for the removal and replacement of existing ceiling tiles and grid in areas of the existing building where its work is required

and new ceilings are not scheduled for installation. In the event that the existing ceilings are damaged and cannot be replaced to the satisfaction of the Owner, the responsible contractor shall be liable for the costs of replacing in kind, the existing ceilings with new tile and grid.

7. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed after hours when the facility is not in use. The performance of this work shall be projected on all schedules required to be prepared by the Contractor. Additionally, the Contractor shall give the Construction Manager and the Owner at least forty-eight (48) hours advance notice of its intention to perform this type of work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Contractor performing the work.

E. 1. Separation of construction areas from occupied spaces: Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas. Methods of dust and fume control shall include, but not be limited to:

- a. Adequate ventilation;
- b. Wetting down;
- c. Keeping bags of insulating materials, cement, etc., closed.
- d. Controlled mixing of materials under field conditions;
- e. Special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials.
- f. Job housekeeping must be maintained;
- g. Advising all personnel of hazardous conditions, including supervisors and workers;

Each contractor is responsible for instituting the above policies to insure minimal impact to surrounding occupied areas.

2. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

3. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

4. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.

F. 1. Storage space will be allotted to the Contractor by the Owner, to the extent such space, in the sole discretion of the Owner is available. The Contractor shall be responsible for securing appropriate space for its material with the Construction Manager prior to delivery. If insufficient space is available on the site, the Contractor shall provide local off-site storage, storage containers, etc. at its own cost and expense. Should any of the material stored on-site obstruct the progress of any portion of the work or the project, this material shall be removed by the Contractor without reimbursement of cost, from place to place or from the premises, as the Construction Manager may direct.

2. The Contractor shall schedule delivery of materials and equipment to minimize long term storage at the Project, to prevent overcrowding of construction spaces, and to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

3. The Contractor shall deliver materials and equipment to the Project in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installation. The Contractor shall inspect materials and equipment upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. The Contractor shall store products to allow for inspection and measurement of quantity or counting of units. The Contractor shall store materials in a manner that will not endanger the Project structure. The Contractor shall store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation. The Contractor shall comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

4. The Contractor shall not unreasonably encumber the site with materials or equipment during the performance of its work. Only materials and equipment which are to be used directly in the performance of the Contractor's work shall be brought to and stored on the premises of the School District. After equipment is no longer required for its work, the Contractor shall promptly remove such equipment from the premises of the School District. The Contractor shall be solely responsible for the protection of construction materials and equipment stored on the premises from weather, theft, damage and all other adversity. The Contractor shall at all times provide the proper housekeeping to minimize potential fire hazards, and shall provide approved spark arresters on all steam engines, internal combustion engines and flues.

5. A construction entrance will be designated for deliveries. A separate entrance will be established for entering and exiting the site only. All deliveries shall be scheduled and coordinated with the Construction Manager and the Owner's Security department. Unexpected or uncoordinated deliveries may be turned away by the Owner or the Construction Manager at the discretion or necessity of the Owner. The Owner's enforcement of this provision shall not be construed by any contractor or subcontractor as the basis for a claim of delay in time or monetary damages alleged to have been incurred as a result of refusal of delivery.

6. The Contractor for General Construction shall provide necessary and required security measures to adequately safeguard the construction site from vandalism and intrusion of unauthorized persons. The Contractor for General Construction shall submit its means and methods of security to the Construction Manager for review and comment. The project site(s) must be secured 24 hours a day, 7 days a week including holidays. The General Construction Contractor's failure to secure the site as required by this paragraph will result in the Owner engaging the services of such necessary personnel so as to provide such security. No notice will be given the Contractor for General Construction of the Owner's intention to engage such security services and all costs and expenses associated with the Owner's security of the site in this regard will be back charged to the Contractor for General Construction. While the Owner may have security guards patrolling the project areas, the function of such security guards is not for the purpose of specifically guarding the Contractor's property or operations of work.

G. The Contractor's right to entry and use of the School District premises arises solely from the permission granted by the Owner pursuant to the agreement between the Contractor and the Owner. This permission shall be deemed to be withdrawn upon the termination of the Contractor's agreement with the Owner.

H. 1. The Contractor shall be required to perform its work with no interruption to the School District's operations, including its administrative and business operations. Any work which will interfere with the School District's operations and/or which is to be performed when the School District's facilities are in operation shall be performed on evenings and weekends. Additionally, the Contractor shall conduct its work in compliance with federal, state, county or local ordinances. All costs incurred by the Owner to make the facilities available during evening and weekends shall be borne by the Contractor. The Owner reserves the right to determine what work will "interfere" with its operations and said determination shall be final.

2. The Contractor may request access to the site during times beyond the work hours permitted. Approval is solely at the discretion of the Owner. If approval is given, the Contractor is responsible for paying all additional costs incurred by the Owner, Architect and the Construction Manager for providing the site to the Contractor during the additional time periods.

3. In the event the Contractor fails to complete all work under this contract by said scheduled dates, the Contractor will not be permitted to perform any work during normal school hours. Such work shall only be performed after school hours, Saturdays, Sundays, holidays or periods when school is unoccupied at no additional cost of any kind to the Owner. In addition to damages incurred by the Owner in connection with the Contractor's delay, the Contractor shall be liable for all costs incurred by the Owner to provide staff, Architect and Construction Manager personnel as required to make facility accessible by Contractor and perform inspections during such off hours.

4. The Owner shall not be responsible for any overtime charges incurred by the Contractor during the course of this project. Any and all costs associated with work which is performed at hours requiring the payment of such overtime by the Contractor to its workers shall be the Contractor's responsibility.

I. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken.

J. The Contractor shall provide all required temporary access walkways, both interior and exterior, and the like necessary to complete its work. The Contractor shall maintain an unobstructed condition at all entrances and/or exits from present buildings. No equipment, other than equipment with rubber tires, will be allowed on any existing or new pavement, UNLESS THE CONTRACTOR HAS OBTAINED THE PRIOR APPROVAL OF THE CONSTRUCTION MANAGER AND THE PAVEMENT HAS BEEN FIRST PROTECTED WITH PLANKING OR BY OTHER MEANS APPROVED BY THE CONSTRUCTION MANAGER.

K. The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the premises of the School District without the prior written consent of the Owner, which may be withheld at the sole discretion of the Owner.

L. 1. Without the prior approval of the Owner, the Contractor shall not permit any workers to use any existing School District facilities, including, without limitation, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Employees, vehicles, and equipment of the Contractor and of all others engaged by the Contractor for the performance of its work shall enter onto the premises of the School District for which construction work is to be performed only at those locations designated or approved by the Construction Manager. The parking for construction personnel shall be limited to the designated trailer park area only. Failure to abide by this rule will result in towing of cars at the expense of the contractor who employs the individual.

2. The Contractor shall ensure that its work, at all times, is performed in a manner that affords reasonable access to both vehicles and individuals, to the premises of the School District and all adjacent areas. The Contractors' work shall be performed, to the

fullest extent possible, in such a manner that areas in and around the construction area shall be free from all debris, building materials and equipment likely to cause hazardous conditions, and do not close or obstruct walkways, roadways or other occupied facilities or facilities to be used by the Owner. Without limitation to any other provision of the agreement between the Contractor and the Owner, the Contractor shall use its best efforts to minimize any interference with the occupancy of areas, buildings, entrances, and parking areas in and around the premises at which work is being performed. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations, and portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site.

3. The Construction Manager, in conjunction with the Owner and the Architect, shall designate locations at the site at which the Contractor, its subcontractors and employees may utilize in connection with its work. The Contractor's employees and the employees of the Contractor's Subcontractors and others engaged by the Contractor to perform its work are prohibited from trespassing or leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's Subcontractors and others engaged by the Contractor to perform its work are prohibited from leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's Subcontractors and other engaged by the Contractor to perform its work are restricted to the immediate area at which work is to be performed. Only persons having official business will be admitted to the construction site. NO COMMUNICATION BETWEEN THE CONTRACTOR, ITS EMPLOYEES, SUBCONTRACTORS' EMPLOYEES, OR OTHERS ENGAGED BY THE CONTRACTOR FOR THE PERFORMANCE OF ITS WORK AND STUDENTS OR STAFF WILL BE PERMITTED.

4. The Contractor, its employees, its Subcontractors and their employees or agents, and all others engaged by the Contractor in connection with the performance of its work are required to wear photographic identification badges at all times. The Contractor shall provide such individuals with said photographic identification badges. These badges shall be worn so as to be readily and easily visible. All workers and representatives of the Contractor, its subcontractors or suppliers shall wear these badges while on school property. The information on these badges shall be as prescribed by the Owner and the Construction Manager. Each person seen without a photo identification badge (or otherwise failing to comply with this requirement in the opinion of the Owner or the Construction Manager) shall be ordered to leave school property. No warnings shall be necessary. The Contractor(s) and their subcontractor(s) employing the offending person(s) shall be solely responsible for making-up and paying for any loss of production or required progress in the Work resulting from this action (including any claims by other Contractors dependent on the work of this Contractor). All parties agree that any action taken to enforce this requirement shall not be construed by any Contractor or its subcontractors or suppliers as the basis for a claim (for either time or money) for delay to the Work or to the Contractor,

its Subcontractors, or Suppliers.

5. Without limitation of any other provision of the agreement between the Owner and Contractor, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the premises of the School District. The Contractor shall immediately notify the Owner in writing if during the performance of its work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternative through which the same results intended by such portion of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations.

M. No drinking of alcoholic beverages, smoking or use of controlled substances is permitted on the grounds. The Contractor shall insure that none of its or its Subcontractors, its employees, agents, and/or consultants report to the site impaired by alcohol or controlled substances. The Contractor bears the responsibility of determining if its, or its subcontractors, employees are in any way impaired and whether the safety of the public, the employees of other Contractors and their Subcontractors, the Owner, Architect, or Construction Manager are jeopardized. Each contractor shall provide drinking water for its own employees.

N. The Contractor's employees, representatives, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to refrain from using indecent language. All doing so will be removed from the site. Artwork or decoration found on vehicles belonging to Contractor or Subcontractor employees parked on or near the school property which contain indecent language or pictures shall either be covered or removed from the location.

O. The Contractor's employees, representative, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to wear shirts, long pants and proper footwear.

P. Each contractor shall keep the premises and surrounding area in which it is working free from accumulation of waste materials or rubbish caused by the performance of all of the work being performed on-site and in the buildings. On a daily basis at the conclusion of work on the project, each contractor shall clean the areas in which it has performed work and shall remove all waste, materials, rubbish, its tools, construction equipment, machinery and surplus materials. Each Contractor shall broom sweep all construction areas in which it has performed worked every day. The Construction Manager shall perform an inspection each afternoon to determine that the work areas of the contractors have been properly cleaned. In the event the work areas are not cleaned, the Construction Manager shall advise the offending contractor to provide cleaning as required herein. If any contractor fails to keep the site safe and clean within four (4) hours of being notified by the Construction

Manager, either verbally or in writing, the Construction Manager will have the cleanup work performed and back charged to the offending contractor without further notification to the Contractor. The cost of such cleaning company, together with the cost of any custodial costs of the School District, at prevailing overtime rates plus 15% will be charged to the offending contractor. Notice to field personnel shall be deemed notice to the Contractor.

Q. The Contractor shall provide ventilation of enclosed areas during construction as may be required to permit proper curing and drying out and to prevent excessive humidity, moisture and condensation. Ventilation shall be by natural or artificial means as required by conditions involved.

R. The Contractor shall be responsible for the control of chemical fumes, gases and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure that they do not enter occupied portions of the building or air intakes.

S. The Contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers' recommendations before a space can be occupied.

T. From the commencement to the completion of the Project, the Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause of water.

U. 1. The General Contractor shall construct temporary partitions where shown on drawings or where otherwise required for safety of the public or to prevent dust from entering occupied areas. Partitions shall be dust-proof from floor to slab or structure above (if existing condition is a drop in tile ceiling, Contractor shall remove tile and install partition to structure above). In addition to framing and sheetrock, the Contractor shall install fire resistant plastic partitions on the work area side of its work. If an access door is required, an alternating 3 layer plastic system shall be used. The door shall be a standard hollow metal door with lockset and closer. Keys shall be distributed to the Owner's other contractors, the Owner and the Architect.

2. Where a contractor other than the General Contractor is the only contractor scheduled to perform work in a particular area of the site at any given time, the responsibilities allocated to the General Contractor in subdivision 1 of this paragraph U shall be performed by such other contractor.

3. All cutting and welding performed within an occupied building or adjacent to a window or intake vent shall be performed during off hours.

V. 1. The Contractor shall control the safe handling and storage of all welding

materials, acetylene and oxygen tanks, and other equipment required for welding and cutting work at the job site. Such storage shall be in compliance with OSHA regulations.

2. Welding materials and equipment shall be removed promptly from the premises upon completion of the welding and cutting work.

W. The Contractor shall be responsible for all costs incurred by the Owner caused by false security/fire alarms set off by the Contractor. Costs shall include custodial response charges etc.

X. The Contractor shall be responsible for broken glass, and at the completion of the Work shall replace such damaged or broken glass. After damaged or broken glass has been replaced, the Contractor shall remove all labels, wash and polish both sides of all glass. In addition to general broom cleaning, the General Contractor shall perform the following final cleaning for all trades at completion of the Work:

1. Remove temporary protections;
2. Remove marks, stains, fingerprints and other soil or dirt from painted, decorated and natural finished woodwork and other Work;
3. Remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;
4. Clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;
5. Clean aluminum in accordance with recommendations of the manufacturer; and
6. Clean all floors thoroughly in accordance with recommendations of the manufacturer.

ARTICLE 5 SUBCONTRACTORS

A. 1. As soon as practicable after receipt of Letter of Intent to Award, Notice to Proceed or other form of official notice of award of the Contract, but not more than ten (10) days after receipt of official notice of award of the Contract, the Contractor shall furnish the Owner and the Architect, in writing, with (1) the name, trade and subcontract amount for each Subcontractor and (2) the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. Copies of all Subcontractor contracts, fully executed, are to be provided to the Construction Manager, including but not limited to all addenda, appendices, and/or exhibits including scope of work sheets. All such subcontracts shall be submitted to the Construction Manager within ten (10) days of the Owner's award of the contract to the Contractor.

2. Upon review of the Contractor's list of Subcontractors, the Architect will advise the Contractor in writing stating whether or not the Owner, the Construction Manager or the Architect, after due investigation, accepts or rejects, any proposed Subcontractor. Subcontractors will not be acceptable unless, when requested by the Architect, evidence is furnished that the proposed subcontractor has satisfactorily completed similar subcontracts as contemplated under this prime contract, and has the necessary experience, personnel, equipment, plant, and financial ability to complete the subcontract in accordance with the intent to the Documents. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years worth of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

3. If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager and Architect have no objection. No increase in the Contract Sum shall be allowed where a sub-contractor is rejected by the Architect, Construction Manager or Owner who is (1) deemed unqualified to perform the particular work subcontracted by the Contractor, (2) does not have the necessary experience, personnel, equipment, plant and financial ability to complete the subcontract, or (3) has a history of poor performance in work of similar nature. Upon receipt of a rejection of a subcontractor by the Owner, Construction Manager or Architect, the Contractor shall have the right to request a meeting with the Architect, Construction Manager and the Owner to discuss the reasons it believes the subcontractor is qualified to perform the work. Upon review of such reasons, the Owner, Construction Manager or Architect shall re-consider its determination and shall advise the Contractor of its determination upon such review. If the Owner, Construction Manager or Architect still finds that such subcontractor does not meet the requirements above-stated, it shall advise the Contractor. The Owner, Construction Manager or Architect's determination upon such review shall be final and binding on the Contractor and its Subcontractor and the Contractor hereby waives any and all claims it or its subcontractor might have against the Owner, the Construction Manager and/or the Architect concerning the rejection of such Contractor and shall require its subcontractors to execute such similar waiver in its agreement with the Contractor.

4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such change.

B. By appropriate agreement, the Contractor shall require each Subcontractor to be bound to the Contractor by terms of the Contractor's agreement with the Owner, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by said agreement, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contractor's agreement with the Owner so that subcontracting thereof will not prejudice such rights, and shall allow the Subcontractor, unless specifically provided

otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by its agreement with the Owner, has against the Owner. However, the Subcontract agreement between the Contractor and Subcontractor shall not provide, nor shall this Agreement be deemed to provide any rights, remedies or redress by the Subcontractor(s) against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors.

C. The Contractor shall promptly notify the Owner, Construction Manager and Architect of any material defaults by any Subcontractors and/or whether it has terminated its agreement with any of its subcontractors for any reason.

D. The Contractor hereby assigns all of its rights in its agreements with its Subcontractor(s) and hereby does assign, transfer and set over to the Owner all of its rights and/or interests in its agreements with its Subcontractor(s), but only in the event of termination of the Contractor's agreement with the Owner pursuant to Article 17, paragraph A of these General Conditions of the Contract for Construction and only to the extent the Owner implements its rights to take such assignment of contract by notifying the Subcontractor in writing of its intention to do so. Such an assignment is subject to the prior rights of the surety, if any, obligated to the Owner pursuant to a performance bond submitted in connection with the Contractor's work.

E. If the Work in connection with a subcontract has been suspended for more than ninety (90) days after termination of the Contract by the Owner and the Owner accepts assignment of such subcontract, the Subcontractor's compensation shall not be adjusted for any increase in direct costs incurred by such Subcontractor as a result of the suspension.

F. It shall be the Contractor's responsibility, when sub-contracting any portion of his work, to arrange or group items of work under particular trades to conform with then prevailing customs of the trade, regardless of the particular Divisions and Sections of the Specifications in which the work is described.

G. All subcontracts must be in writing.

ARTICLE 6

CONTRACTOR'S USE OF DRAWINGS/SPECIFICATIONS

A. The Agreement between the Owner and Contractor, and all documents incorporated therein by reference, including but not limited to, the drawings and project manual shall be signed by the Contractor and the Owner.

B. The intent of the agreement between the Owner and the Contractor is to include all items necessary for the proper execution and completion of the work to be performed by the Contractor. The documents comprising the agreement between the Contractor and the Owner are complementary, and what is required by one shall be as binding as if required

by all.

C. 1. In the event of inconsistencies within or between parts of the agreement between the Contractor and the Owner or between the agreement between the Contractor and the Owner and applicable standards, codes and ordinances, the Contractor shall (a) provide the better quality or greater quantity of Work or (b) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation.

2. On the Drawings, given dimensions shall take precedence over scaled measurements and large scale drawings over small scale drawings.

3. Before ordering any materials or performing any of its work, the Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the performance of the work.

4. If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

5. Drawings, in general, are made to scale, but all working dimensions shall be taken from the figured dimensions or by actual measurements at the job and in no case by scaling. The Contractor shall study and compare all Drawings and verify all figures before laying out or constructing the work and shall be responsible for any and all errors in his work which might have been avoided thereby. Whether or not an error is believed to exist, deviation from the Drawings and the dimensions given thereon shall be made only after approval in writing is obtained from the Architect.

6. In the event addendum (a) are issued and contain changes to the Drawings and/or Specifications, the provisions in the addendum (a) supersede previously issued Drawings and/or Specifications.

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

E. Unless otherwise stated in the agreement, words and abbreviations which have well-known technical or construction industry meanings are used in the agreements in accordance with such recognized meanings.

F. The Contractor, and all Subcontractors, shall refer to all of the Drawings, including those showing the work of others performing work in connection with the project,

including but not limited to the General Contractor (if any), the Plumbing Contractor, the Heating, Ventilation, Air Conditioning Contractor, Electrical Contractor and other specialized trades, and to all of the Divisions of the Project Manual, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.

G. All indications or notations on the drawings which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the drawings or project manual. All work mentioned or indicated in the drawings or project manual shall be performed by the Contractor unless it is specifically indicated therein that the work is to be performed by others.

H. The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's service through which the Contractor's work is to be performed. The Contractor may retain one contract record set during the course of the project. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work.

I. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects without the specific written consent of the Owner and Architect. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the performance of its work pursuant to its agreement with the Owner. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

J. The Owner shall furnish surveys describing physical characteristics of the site, upon written request of the Contractor and to the extent such survey is in existence at the time of said request, legal limitations and utility locations for the project sites. Nothing herein shall be construed as requiring the Owner to generate any document which it does not possess at the time of the request by the Contractor. In the event that the survey provided does not clearly delineate the metes and bounds of the Owner's property, the Contractor shall stop work and immediately notify the Architect, Construction Manager and the Owner. The

Contractor shall NOT proceed with its work until it receives written permission from the Construction Manager and/or the Architect. The Contractor shall be fully responsible for all costs arising from non-compliance with this provision. Any delays associated with this provision shall not serve as a basis for a claim by the Contractor.

K. From the basic data established by the Owner, the General Contractor shall establish reference control points and complete the layout of the work. Each Contractor is responsible for utility markouts as it pertains to the scope of their work and maintain markout during work. Sketch of layout with reference points to be given to Construction Manager and Architect at the time of markout.

L. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the specifications, shown on the drawings, or as the same may be modified at the direction of the Architect to meet changed conditions.

M. The General Contractor shall be responsible for the establishment of points, wall and partition lines required by the various Prime Contractors and subcontractors in laying out their work.

N. Each Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the work from the base lines and bench marks established by the Owner.

O. 1. The General Construction Contractor shall establish a baseline and benchmark system for each building addition, area of renovation or component using the services of a licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall have not less than five years experience in performing construction surveys similar to the work they will perform for this project. The remaining Contractors and their respective subcontractors shall be responsible for extending these lines, levels and grades, and for performing all layout for their own work. The Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level or grades in their layout. The Contractor and its subcontractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the drawings, perceived by another contractor or subcontractor shall be immediately reported to the Construction Manager. If any corrections are necessary, they shall be executed in accordance with the terms and provisions of these General Conditions.

2. The Contractor and its subcontractors shall be responsible to offset or to protect their markings from anything that may disturb them.

3. Every contractor shall work off the lines and elevations established and maintained as the baseline and benchmark system.

4. Each Contractor is responsible for the accuracy of his own work.

P. The Architect may require that construction work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed work or the work in progress.

Q. Except for the basic building permit, the Contractor shall be responsible for securing and maintaining for the life of the project: all permits, P.E. Licenses, connection fees, inspections, etc. applicable to, or customarily secured for the work. This provision includes any permits to be issued in the name of the Contractor required for the work. Originals of all permits are to be issued in the name of the Contractor as required for the work. The Contractor shall furnish the Construction Manager with original copies of all permits prior to the commencement of the work, and shall prominently display a copy of all permits at a location approved by the Construction Manager.

R. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

S. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contracts, is not guaranteed by the Architect or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, utilities and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.

T. 1. The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define its work in greater detail, or to permit the proper progress of its work. To the extent the Architect advises the Contractor that the existing design drawings, specifications and/or instructions given are sufficiently detailed for the Contractor to perform its work, the Architect shall be under no obligation to further clarify or define the work to be performed. In all other circumstances, the Architect shall issue a field order which responds to the request for information.

2. Requests for Information (RFIs) are for requests on clarifications or questions on contract drawings and specifications, not contract terms, scheduling items, or general correspondence, nor, as a means to describe or request approval of alternate construction means, methods or concepts or substitution or materials, systems means and methods. The Contractor shall fill all RFIs out in accordance with the provisions of the Project Manual. Neither the Architect nor the Construction Manager shall fill said forms out on the

Contractor's behalf.

U. The Contractor shall, prior to the start of any portion of the Work:

1. review any specified construction or installation procedures, including those as may be recommended by the proposed manufacturer.
2. advise the Architect if the specified procedure(s) deviates from good construction practice.
3. advise the Architect if following said procedure(s) will affect any warranty, including the contractor's general warranty.
4. advise the Architect of any objections the Contractor may have to the specified procedure(s).
5. propose any alternative procedure(s) which the Contractor will warrant.

V. 1. To the fullest extent possible, the Contractor shall provide products of the same kind, from a single source. When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.), they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. The Contractor shall provide products which are compatible within systems and other connected items. If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

2. The Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

3. With respect to sitework materials, all products submitted for use and incorporated into this project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

4. All products submitted for use and incorporated into this project shall be asbestos free.

W. Equivalents. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Contractor may select one of these items or, if the contractor desires to use any kind type, brand, or manufacturer or material other than those named in the specifications, they shall indicate in writing, and prior to award of contract, what kind, type, brand or manufacturer is included in the base bid for the specified item. The Contractor shall follow the submission requirements for substitutions as set forth in Article 6.X below.

X. 1. Substitutions. If the Contractor desires to substitute any kind, type, brand, or manufacturer of material other than those named in the Specifications, the Contractor shall request in writing that it be permitted to make a substitution for the specified manufacturer or materials and shall indicate the following:

- a. For which specified material or equipment the request for substitution is being made;
- b. What kind, type, brand, or manufacturer is sought to be substituted for the specified items;
- c. Written documentation evidencing that the substituted material or equipment meets or exceeds the specifications for materials and/or equipment set forth in the project manual. Such documentation shall include, but not limited to, a full explanation of the proposed substitution, together with a submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, significant qualities of proposed substitution (e.g. performance, weight, size, durability and visual effects), and other like information necessary for a complete evaluation of the substitution. Additionally, the Contractor shall provide material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. All such data shall be provided to the Architect and Owner at the Contractor's sole expense. The Contractor's written explanation shall also include a list of reasons the substitution is advantageous and necessary, including the benefits to the Owner and the project in the event the substitution is acceptable. Additionally, the Contractor shall submit to the Architect information describing in specific detail how the proposed substituted product differs from the quality and performance required by the base specifications, and such other information as may be required by the Owner or the Architect.
- d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

e. Samples, where applicable or requested.

f. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

2. By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:

a. Represents that a representative of it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified.

b. Represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product.

c. Certifies that the cost data is complete and includes all related costs under this contract, including professional services necessary and/or required for the architect and engineers to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent.

d. Represents that it will coordinate the installation of the accepted substitute, making all such changes to the drawings effected by the change, including but not limited to the electrical, plumbing, site work and heating and ventilating specifications as may be required for the work to be complete in all respects.

e. An affidavit stating that (1) the proposed substitution conforms and meets all the requirements of the pertinent Specifications and the requirements shown on the Drawings and (2) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect; and the proposed substitution will have no effect on the construction schedule.

3. Proposals for substitutions shall be submitted in triplicate to the Architect in sufficient time to allow the Architect no less than fourteen (14) working days of award of contract for review.

4. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

5. All proposed substitutions shall be submitted to the Architect within fourteen (14) working days of the award of the contract to the Contractor. *(This provision 6(X)(5) shall not apply to equivalents.)*

Y. 1. Submittal of shop drawings, product data, material safety data sheets, samples or similar submittals shall be in accordance with the provisions of the project manual.

2. The Contractor represents and warrants that all shop drawings have been prepared by persons and entities possessing expertise and experience in the trade for which the shop drawing is prepared and, if required by the Architect or applicable law, by a licensed engineer, job specific, reviewed by Contractor and stamped by the Contractor.

3. If the Contractor elects to perform its work without approvals, such work shall be at the Contractor's own risk and expense.

4. By approving and submitting shop drawings, product data, samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of its work.

5. The Contractor shall not be relieved of responsibility for deviations from requirements of its work by the Architect's approval of shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors and/or omissions in the shop drawings, product data, samples or other of its submittals to the Architect, by the Architect's approval thereof.

6. The Architect shall review, approve, reject or take other appropriate action respecting submittals made by the Contractor as set forth in the Project Manual. The Architect shall check for conformance with information given in the drawings and project manual and the design concept expressed in the agreement between the Owner and the Contractor. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems designed by the Contractor, all of which remain the responsibility of the Contractor. Further, the Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of construction means, methods, techniques,

sequences or procedures.

The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon such certification to establish that the materials, systems or equipment will meet the performance criteria required by the Contract Documents.

7. Upon the Architect's rejection of the Contractor's shop drawings, product data, samples and/or other documentation submitted by the Contractor to the Architect, the Contractor shall review the rejection and re-submit such shop drawing, product data, sample and or other document in accordance with the Architect's instruction. The Contractor shall direct the Architect's specific attention in writing or on re-submitted shop drawings, product data, samples, or similar submittals, to revision which have been made, including revisions not specifically requested by the Architect. Resubmission of rejected documents shall be performed within ten (10) calendar days. No claim for delay or cost shall be accepted as a result of rejected documents.

8. When professional certification of performance criteria of materials, systems or equipment is required of the Contractor, the Architect shall be entitled to rely in a reasonable and professional fashion upon the accuracy and completeness of such calculations and certifications provided, however, if the Architect, in its reasonable and professional judgment considers it advisable, the Architect shall verify the accuracy and completeness of any and all such calculations and/or certifications. In the event any and all such calculations and/or certifications are found to be inaccurate and/or incomplete by the Architect, the Contractor shall assume full responsibility and bear all costs attributable or related thereto, including, without limitation, the expense of the Architect's additional services associated with the verification of such calculations and/or certifications and the expense of the Architect's additional service made necessary by the failure of such calculations and/or certifications to be accurate or complete.

9. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review as set forth in the Project Manual.

Z. The Architect will interpret and decide matters concerning performance under and requirements of the drawings and/or technical specifications on written request of the Contractor. Such interpretations may, at the Architect's option, be issued in the form of additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Contractor's work. Such drawings or instructions may be forwarded by the Architect to the Contractor by field order, construction change directive or other notice to the Contractor. The Contractor shall execute the work for which it requested an interpretation in accordance with such additional drawings or instructions

without additional cost or extension of its contract time. After a decision has been rendered by the Architect on a matter for which the Contractor sought the Architect's interpretation of the drawings and/or technical specifications, the Contractor shall proceed with the work as directed by the Architect. Failure to proceed with the work in accordance with the Architect's interpretation may be used as a basis for termination of the Contractor's contract pursuant to Article 17 of these General Conditions.

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

BB. The Contractor shall maintain at the site, and shall make available to the Owner, Construction Manager and Architect, one record copy of the Drawings (the "Record Drawings") in good order. The Record Drawings shall be prepared and updated during the prosecution of the Contractor's work. The prints for Record Drawing use will be a set of black line prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (i) deviations from the Drawings made during construction; (ii) details in the work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (iv) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs, etc.; (v) architectural and/or structural changes in the design; and (vi) such other information as either Owner or Architect may reasonably request. At the completion of the work, Contractor shall transfer all information on record drawings to reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower right hand corner. The colored record drawing and the as-built reproducible drawing shall be forwarded to the Construction Manager for delivery to the Owner. Final payment and any retainage shall not be due and owing to Contractor until the Record and/or As Built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

CC. The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies. All approved drawings shall be wrapped, marked and delivered to the Owner within sixty (60) days of final completion of the Contractor's work.

DD. Each Prime Contractor shall be furnished, free of charge, 3 copies of the Contract Documents and Project Manuals, including all Addenda. Any and all additional copies will

be furnished to the Contractor at the cost of reproduction, postage and handling.

ARTICLE 7

CONTRACTOR'S SAFETY/SECURITY PROGRAM

A. 1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of its work. Prior to beginning any work, the contractor shall submit a copy of its corporate safety plan to the Owner and the Construction Manager. Two (2) weeks after receipt of the Notice to Proceed, the Contractor shall provide a Site Safety/Logistics Plan to the Construction Manager. The Site Safety/Logistics Plan should minimally include locations of the eight-foot high temporary fence and gates, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radius, and lift locations, stockpiles, toilet locations, site water and power locations, and safety. This plan shall also show the location of all staging and storage areas, clearly separating construction and school areas. The logistical information represented by the construction documents shall serve as a minimal guide. Each contractor is required to submit their corporate safety policy within ten (10) days of receipt of the Notice to Proceed. Said policy must minimally meet OSHA standards and define details concerning the maintenance of a safe work environment. The Contractor shall make the participation of its subcontractors in its safety program mandatory. A list of key personnel, with addresses and telephone numbers for emergency purposes shall be forwarded to the Construction Manager and Architect. The Owner and the Construction Manager shall establish a fire coordination procedure and shall forward same to the Contractor for its use during the performance of its work.

2. Effective July 1, 2008, all laborers, workers, and mechanics employed in the performance of the work of this Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least ten (10) hours in duration.

The Contractor and its subcontractors shall conduct their operation in accordance with the Safety Guides for Construction as issued by the SED, and, the Contractors' Safety Program.

3. All safety equipment including hard hats and weather protective gear required for the Contractor to perform its work are to be supplied by the Contractor and/or its subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, and/or other agents, and its subcontractors, employees, superintendents, and/or other agents are required to wear hard hats and other required and/or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the project. No prior warnings will be given by the Owner or Construction Manager and Architect. The Contractor and its subcontractors

shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

4. The Contractor and its subcontractors shall provide blankets and auxiliary fire protection as part of its construction safety program to prevent damage to adjacent work or materials as a result of its welding or burning operations. Additionally, as part of its construction safety program, the Contractor and its subcontractors shall provide a fire watch, with a fire extinguisher, which is acceptable to the Owner and the Construction Manager.

5. The Construction Manager and/or Owner reserve the right to have all operating equipment periodically inspected by an independent inspector whose finding will be binding. The Prime Contractor, at its own expense, must make corrections within two (2) working days of receiving a written report.

6. All flagmen required for deliveries to the site are to be furnished by the Contractor or its Subcontractors responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagmen. All flagmen shall wear orange vests.

B. The Contractor shall schedule weekly safety meetings and each of its subcontractors must be properly represented at such meetings. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. The Contractor shall notify the Construction Manager in writing its "OSHA Competent Person Regarding Safety". Said person must be an individual capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Construction Manager and Architect. The Contractor shall take all necessary steps to prevent its employees from disturbing and/or damaging the facility and shall be responsible for preventing the escape of fires set in connection with the construction. The Contractor shall notify its employees and subcontractors of the location of the nearest fire alarm box at all locations where the work is in progress. On a weekly basis, the Contractor shall submit to the Construction Manager and Architect minutes of its safety meetings, which minutes shall include a list of the individuals present at such meetings.

C. The Contractor and each of its subcontractors shall conduct its/their operation in accordance with all applicable laws, regulations and order of local, state and federal governments. The Contractor agrees, in order that the work will be completed with the greatest degree of safety to conform to the requirements of the Occupational Safety and Health Act of 1970 (OSHA) and the Construction Safety Act of 1969, including all standards

and regulations that have been since or shall be promulgated by the governmental authorities which administer such acts.

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

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

F. The Contractor shall take reasonable precautions for the safety and protection of employees at the project site and other person who may be affected by its work, including but not limited to students, staff, employees and agents of the Owner, the Construction Manager and the Architect.

G. The Contractor shall protect and secure its work and the materials and/or equipment to be utilized in connection with its work, whether stored on or off the site and whether in its care, custody and control or that of its Subcontractors, subcontractors to its subcontractors, or material suppliers.

H. The Contractor shall take all steps necessary to protect all property at or adjacent to the site, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

I. All delivery vehicles/trucks/machinery/etc. permitted on the site must be equipped with back-up alarms and enter through the designated access points. The Contractor's failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the contractor responsible for the work involved.

J. All crane picks, materials delivery, etc. must be coordinated so as not to lift over any occupied area of the building. If absolutely necessary, this work shall be done on off hours to insure the safety of the building occupants. Crane location must approved by the Construction Manager to insure the safety of building occupants.

K. The Owner or Construction Manager reserves the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Contractor, at its own expense, must make corrections cited by the inspector before continuing work. The Owner or Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. The Contractor and/or its subcontractor(s) shall cooperate with the inspector by allowing time

for the inspection. The Contractor shall be notified twenty four (24) hours prior to the time of the inspection. These inspections do not release the Contractor of its responsibility to provide all engineering, permits and inspections as required by OSHA or the New York State Education Department prior to use of any hoisting equipment.

L. The Construction Manager, the Owner, and/or the Architect will not assume any responsibility for the safe operation of any cranes or equipment by exercising this right. The Contractor and its subcontractors shall cooperate with the inspector by allowing time for inspection. The Contractor will be notified 24 hours prior to the time of the actual inspection. The Contractor is obligated to perform all engineering, obtain permits, and to have all hoisting equipment inspected as required by OSHA, Village, Town, County, State, and Federal regulations as well as any other agency having jurisdiction. Copies of all inspection reports and certificates must be transmitted to Construction Manager as soon as possible.

M. The Contractor shall use the entrances designated on the site logistic plans and drawings for personal vehicles, trucks, equipment, deliveries and the like.

N. All interior temporary partitions and emergency egress barriers (if required) are to be installed on an after hours basis (weekends/school holidays).

O. 1. When use or storage of hazardous materials or equipment or unusual construction methods are necessary to perform its Work, the Contractor shall obtain the Owner and the Construction Manager's consent for the use of such materials, equipment or unusual construction methods. In the event the Owner determines that the use of such hazardous material or equipment or unusual construction methods can be performed by the Contractor with alternative means, methods and/or techniques, the Contractor shall employ such alternate means of prosecuting its work at no additional cost to the Owner.

2. In the event the Owner approves the use or storage of such hazardous materials, equipment or unusual construction methods, the Contractor shall provide for the Owner's and the Construction Manager's use a full set of safety instructions relating to all such materials. Additionally, when the Owner and/or the Construction Manager reviews the use of storage of such hazardous materials, equipment and or unusual construction methods, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

3. Transportation, storage, and use of explosives shall be in strict accordance with all local, state and federal regulations, statutes, and requirements. All safety precautions as set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, Inc. shall be observed.

4. The Contractor is responsible for its own storage and personnel trailers at the site. The Contractor will be required to supply man trailers and storage box trailers as

required. All costs related to delivery, construction, protection, power, etc. for said trailers is the responsibility of the contractor utilizing the space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of personnel and/or storage trailer will be strictly limited to pre-determined locations. The Contractor shall obtain the written approval of the placement of any trailer or storage box from the Construction Manager.

P. During construction, the General Contractor shall be responsible for maintaining a watertight structure. This shall include additions and existing buildings. The contractor shall be responsible for temporary roofing, tarps and other protection at roofs, cavity walls, etc. Should the contractor fail to provide adequate protection, causing flooding, damage or other disturbance to the existing building, contractor shall be responsible for all costs associated with clean up and repairs. Inasmuch as flooding and damage have safety implications to the general public, clean up and repairs may be made by the Owner without warning to the Contractor. Administration costs incurred by the Owner and Architect will also be back charged to the Contractor. The Contractor, by entering into contract with the Owner agrees to be liable for these costs.

Q. When all or a portion of the Contractor's work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the work, as necessary, from injury by any cause.

R. 1. The Contractor shall promptly remedy damage and loss to all property of the Owner, or adjacent to the Owner's property (other than damage or loss covered by insurance) caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

2. Title to all completed or partially completed work at the job site, and to all materials delivered to and stored at said job site which are intended to become a part of the completed work covered by the agreement between the Contractor and the Owner, shall be in the name of the Owner. Notwithstanding the foregoing, and prior to acceptance of the completed work by the Owner, the Contractor shall be liable for all loss of or damage to said completed work, partially completed work, materials furnished by the Contractor, and/or materials or equipment furnished by others, the custody of which has been given to the Contractor, arising from any cause other than those against which the Owner herein undertakes to carry insurance. In the event of loss or damage from cause other than those against which the Owner undertakes to carry insurance, the Contractor shall replace or repair the said work or materials at his own cost and expense, to the complete satisfaction of the Owner, the Construction Manager and the Architect.

S. The Contractor shall promptly report in writing to the Owner, the Architect and the Construction Manager all accidents arising out of or in connection with the Work which cause death, person injury, or property damage, giving full details and statements or any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, Construction Manager and the Architect.

T. 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.

U. Any and all fines or citations levied against the Owner, Architect, or Construction Manager due to the failure of the Contractor to comply with regulations of any governing authority, shall be paid for by the Contractor. This shall include any interest or late charges which accrue due to the Contractor's failure to remit payment upon receipt of such levies.

V. The Contractor shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly or indirectly employed by such Contractor, with respect to violations of OSHA requirements, rules and/or regulations.

W. The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, and to the extent permitted by law, the Contractor is solely responsible for compliance with all such laws and regulations imposed for the protection of persons performing the Contract.

X. The Contractor shall indemnify and hold harmless the Owner, Architect, and Construction Manager, of and from any and all liability for violation of such laws and regulations and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner, Architect or Construction Manager in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

Y. The Contractor and its subcontractors shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly employed by such Contractor, for the act and/or omissions of any Contractor or Subcontractor that

resulted in an incident and/or accident causing personal injury and/or property damage.

ARTICLE 8 CHANGES IN THE WORK

A. Without invalidating the agreement between the Owner and the Contractor, and without notice to the Contractor's surety, the Owner may, at any time or from time to time, order additions, deletions or revisions in the Contractor's work. Such additions, deletions or revisions will be authorized by field order, change order, or construction change directive.

B. Field Orders are an interpretation of the contract drawings and/or specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contractor's total contract sum. From time to time, the Architect may issue field orders to the Contractor. The work included in such field order shall be performed by the Contractor at no additional cost to the Owner and shall not form the basis for a claim for an extension of time of the Contractor's time to complete its work. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its work and/or the work of other contractors engaged by the Owner in connection with the project. All field orders shall be given to the Contractor and the Construction Manager by the Architect in writing.

C. 1. When the Owner or Architect in association with the Construction Manager request that the Contractor perform work which is not included in the contract drawings or specifications and which will result in additional cost to the Owner, the Architect shall request that the Contractor submit its proposal for performing such additional work. The Contractor shall submit its proposal to the Construction Manager and Architect for review. The Contractor's proposal shall include a complete itemization of the costs associated with performing its work including labor and materials. All proposals for any work that a Contractor, its subcontractor(s) or subcontractor(s) of subcontractor(s) perform in connection with additional work shall be submitted using the following format and in no event shall the total for overhead and profit on any change order exceed fifteen percent (15%) of the cost of the work.

1.	Materials (Itemized Breakdown) including quantities and cost	
2.	Labor (Itemized Breakdown)	
3.	Subtotal (Add lines 1 and 2)	
4.	Credit for work not required due to additional or changes to the work reflected in the within change order (if any)	
5.	Overhead (10% x line 3)	
6.	Subtotal (Add lines 3 through 5)	
7.	Sub-Contract Work (include itemized breakdown.	

	Sub-Contractor(s) overhead and profit allowed is 10%	
8.	Subtotal (Add lines 6 and 7)	
9.	Profit (5% x line 8)	
10.	Subtotal (add lines 8 and 9)	
11.	Rental Value of Equipment (Itemized Breakdown)	
12.	Actual additional charges for bonds	
13.	TOTAL CHANGE ORDER (Add lines 10, 11 and 12)	

2. All proposals submitted by the Contractor without the itemization indicated herein will be returned to the Contractor for re-submission by the Contractor. For any work performed by the Contractor's own forces, fifteen percent (15%) for overhead and profit will be allowed for labor and material related costs. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall any change order proposal exceed fifteen percent (15%) of the cost of overhead and profit.

The Contractor shall not be entitled to recover overhead and profit on the rental value of equipment and machinery. "Equipment and machinery" shall not include (1) tools customarily used by the contractor's trade, including but not limited to hand tools, and/or (2) equipment and machinery already on site and being utilized by the Contractor for the original scope of work.

The Contractor shall submit with its change order proposals actual invoices from its insurance broker reflecting actual additional costs associated with the procurement of bonds.

3. The Contractor's subcontractor's proposal for any work it is to perform in connection with the additional work shall only include ten percent (10%) for the subcontractor's overhead and profit including sub-subcontracted work. The Contractor is entitled to five percent (5%) on work performed by its subcontractor in accordance with paragraph C (1) of this Article 8. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall the Contractor or the Contractor's subcontractor(s) be entitled to be reimbursed for overtime, except when specifically approved by the Owner in writing and not as an Extraordinary Measure as set forth in Article 13, and in such event the Contractor shall be paid for by the Owner on the basis of premium payment.

4. Notwithstanding the foregoing, work which is performed pursuant to an allowance included in the Contractor's base contract, the provisions of Article 9, paragraph B, concerning itemization of such work shall be controlling.

5. a. A change in the Contract Sum shall be accomplished only by a written Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, whether or not there

is, in fact, any unjust enrichment to the Work, shall be the basis of any claim as defined in Article 18 of these General Conditions to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents. **No amount shall be payable by the Owner to the Contractor for performance of work without a written and fully executed Change Order.**

b. Upon the Contractor's completion of the change order work, and prior to payment being made to the Contractor for such work, the Contractor shall provide the Owner with the following information:

1. Certified payrolls itemizing the labor actually utilized in connection with the change order work.
2. Copies of invoices from subcontractors supplying work in connection with the change order work.

D. 1. When the Owner or Architect request that portions of the Contractor's work originally included in the contract drawings or specifications be deleted and which will result in a reduction of the Contractor's original contract sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such work from its contract. The Contractor's proposal shall include a complete itemization of the costs associated with deducting such work including labor and materials and shall be submitted using the format set forth in Article 8, paragraph C(1) of these General Conditions of the Contract for Construction or the schedule of values, whichever is greater. The Contractor shall not be entitled to retain its overhead and/or profit for such work nor shall any of its subcontractors which were to perform the work being deducted from the Contractor's scope of work. Additionally, the Contractor shall reflect the reduced cost of premiums on bonds which are to be supplied herein as a result of such change. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase/decrease with respect to that change.

2. The Owner may in its sole discretion deduct and/or reduce the scope of the Contractor's contract with or without any specific reasons therefor.

E. 1. In the event the Contractor and the Owner cannot agree on the sum by which its contract with the Owner is to be increased or reduced based upon changes to the scope of the work as described in Article 8, the Architect shall issue a construction change directive reflecting the deduction and/or reduction of the scope of the Contractor's contract and the Contractor will (a) in the case of additional work to be performed by the Contractor, perform such additional work in an expeditious manner so as not to delay the work of this or other contractors working at the site, and (b) in the case of work to be deducted from the scope of the Contractor's work, refrain from taking any steps in connection with the work associated with the deduction and/or reduction of the scope of

the Contractor's work. The construction change directive shall include (a) a description of the work being added or deducted from the Contractor's scope of work; (b) the amount the Owner has determined to be the cost associated with the additional work or deduction and/or reduction of the scope of the Contractor's contract until the Owner and the Contractor agree upon the increase or decrease in the Contractor's contract sum, or until a claim filed by the Contractor has been determined; (c) the extent to which the contract time will be adjusted as a result of the change in the scope of work. Any claims must be filed in accordance with the requirements set forth in Article 18 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

2. In the event the Contractor and the Owner reach agreement on the amount by which the Contractor's contract sum is to be increased or decreased based upon changes to the scope of the Contractor's work as described in Article 8, the Architect, Owner, Construction Manager and Contractor shall sign a change order reflecting such agreement. The change order shall include (a) the description of the change in the scope of the Contractor's work; (b) the amount of the adjustment to the Contractor's contract sum, if any; and (c) the length of time by which the time to complete the contract will be adjusted, if any. Agreement between the Owner and the Contractor in connection with any change order shall constitute a final settlement of all matters relating to the change in the Contractor's work as reflected in said change order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contractor's contract sum and the construction schedule. All such change orders for which the Owner and the Contractor have reached agreement shall be included as a separate line item in the Contractor's applications for payment as if originally part of the Contractor's agreement with the Owner.

F. Neither the Owner, the Construction Manager nor Architect may issue instructions to the Contractor to change the amount of the Contract, except by properly executed Change Orders. Instructions are issued by the Owner or the Construction Manager through the Architect, to the Contractor. The instructions shall not be carried out by the Contractor prior to a written order in the form of a Change Order, signed by the Owner, Architect and Contractor, authorizing a change in the Contract amount or an adjustment to the Contract Sum. No amount shall be payable by the Owner to the Contractor for performance of work without an executed Change Order.

ARTICLE 9 PAYMENTS

A. 1. Prior to commencing its work on the project and within one (1) week of receipt of a Notice to Proceed, the Contractor shall submit to the Construction Manager and the Architect, a schedule of values which includes the amount of money it has allocated in its bid price for the following items of work which are applicable to the Contractor's work.

Said schedule of values shall include each of the CSI division sections reflected in the specifications and applicable to the contract for which the Contractor has been awarded the contract, together with the requirements for bonds/insurance (based upon actual invoice amount), general conditions, meeting attendance and meeting documentation (at least two (2) percent of the contract sum), shop drawing/product data/sample submissions (at least one (1) percent of contract sum), labor and materials on line items as applicable, temporary utilities and services, HVAC balance reports, coordination drawings, punchlist (at least one (1) percent of the contract sum), warranties/guarantees and close out of the project (at least three (3) percent of the contract sum), and allowance, where applicable.

2. Any schedule of values which fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Contractor's work will be rejected. Furthermore, if the schedule of values has been approved by the Construction Manager and the Architect and is subsequently used, but later is found by the Construction Manager or Architect to be improper for any reason, sufficient funds shall be withheld from the Contractors' future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's work.

3. The schedule of values shall be drafted so as to reflect multiple construction sites, multiple locations within each site, additions versus renovations of work, and the like so as to satisfy any New York State Education Department requirements for the project.

4. The Schedule of Values prepared by the Contractor must be approved by the Construction Manager and the Architect prior to the payment of any sums due the Contractor.

B. The Contractor shall include in its contract sum all allowances stated in the specifications. However, the Contractor's costs for unloading and handling at the site, overhead, profit and other expenses contemplated for the stated allowance amounts shall be included in its contract sum and not in the allowances.

C. The Contractor shall submit its applications for payment to the Construction Manager and the Architect on a periodic basis. The form to be used by the Contractor shall be AIA 702/CMA and 703/CMA approved by the Construction Manager, the Architect and the Owner for use in connection with the Contractor's work. The form shall be divided in sufficiently in the same form as the Contractor's schedule of values and shall reflect in separate line items for the work:

1. Total value of the work listing labor and material separately
2. Percentage of work completed at the time of submission of the application for payment
3. Value of the work completed at the time of submission of the application for payment
4. Percent of previous amount billed

5. Previous amount billed
6. Current percent completed;
7. Value of work completed to date
8. Percent remaining to be completed by the Contractor; and
9. Value of work remaining to be completed by the Contractor

D. 1. Payments to the Contractor shall be based upon materials and equipment delivered and suitably stored at the site and/or incorporated into the Contractor's work, together with the labor utilized by the Contractor in connection with its work. The Contractor may be paid for materials and/or equipment which has been delivered to the Owner's facilities but which, at the time of submission of its application for payment, has not yet been incorporated into the Contractor's work upon such conditions and requirements as the Owner, the Construction Manager and/or the Architect may advise the Contractor it must satisfy.

2. The Construction Manager and Architect shall review the application for payment submitted by the Contractor and shall advise the Contractor of any adjustments to be made thereto. The Construction Manager and/or the Architect may make such adjustments under the following circumstances:

- a. the Contractor's failure to remedy defective work;
- b. the filing of third party claims or reasonable evidence that there is a probability that such claims will be filed;
- c. receipt by the Owner of a notice of withholding from the New York State Department of Labor or other administrative agencies having jurisdiction over the project;
- d. the Contractor's failure to make proper payments to its subcontractors or material suppliers for labor, materials and/or equipment;
- e. reasonable evidence that the Contractor will not complete its work for the unpaid balance of the remaining monies on its contract;
- f. damages caused to the Owner, Construction Manager, the Architect or another contractor as a result of the Contractor's performance of its work;
- g. reasonable evidence that the Contractor will not complete its work in accordance with its agreement with the Owner, and/or that the remaining monies available on the Contractor's contract will not be sufficient to cover actual or liquidated damages for the anticipated delay;
- h. the Contractor's failure to carry out its work in accordance with the contract drawings and/or specifications;
- i. the Contractor's failure to notify the Architect of errors or inconsistencies between and among the contract drawings and specifications;
- j. the Contractor's and/or its subcontractors' failure to comply with the requirements for maintaining record drawings;
- k. the Architect's and/or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective

and/or incomplete;

- l. such other acts and/or omissions by the Contractor in connection with the performance of its work.
- m. The amount requested exceeds the percent completion of work on the site.

3. After any such adjustments are made to the Contractor's application for payment, the Contractor shall submit four (4) copies of the final draft of its application for payment to the Construction Manager and Architect, which shall be accompanied by the following documentation:

- a. a current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material suppliers in the requested progress payment and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers;
- b. duly executed waivers of public improvement liens from all Subcontractors and material suppliers and lower tiered Subcontractors or material suppliers establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment; and AIA Form G706 or G706A.
- c. Certified payroll for employees of the Contractor and employees of subcontractors performing work on the Project.
- d. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.
- e. Such other information which the Owner, Construction Manager and/or the Architect request the Contractor furnish in connection with its application for payment.

4. Upon submission of its application for payment, the Contractor represents that it is entitled to payment in the amount for which it seeks payment.

5. The Owner shall make payment to the Contractor within forty-five days of receipt of the Contractor's requisition of payment unless such requisition of payment is not in accordance with the terms of the Construction Documents.

6. Upon receipt of payment by the Owner, the Contractor shall promptly make

payment to each of its subcontractors and/or material suppliers for which it has received payment from the Owner. This provision does not obligate the Architect, the Construction Manager and/or the Owner to ensure payment to the Contractor's subcontractors and/or material suppliers.

7. a. In the event a subcontractor and/or material supplier files with the Owner a public improvement lien, the Owner shall withhold payment on previously certified applications for payment which have not yet been paid or subsequent applications for payment submitted by the Contractor an amount equal to 150% of the amount set forth in such public improvement lien. This provision is in addition to and does not supersede the indemnity provisions set forth in Article 12 of these General Conditions.

b. The Owner may release any payment withheld due to the filing of a public improvement lien if the Contractor obtains security acceptable to the Owner or a lien bond which is : (1) issued by a surety acceptable to the Owner, (2) in form and substance satisfactory to the Owner, and (3) in an amount not less the 150% of such lien claim. The cost of the premiums for any such bond posted shall be borne solely by the Contractor. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of its obligations pursuant to these General Conditions, including but not limited to the indemnity provisions set forth in Article 12 of these General Conditions.

E. 1. The Contractor shall not be entitled to payment for materials and/or equipment stored off the site unless previously approved in writing by the Owner, Architect, and/or the Construction Manager and upon the Contractor meeting any and all conditions which the Owner, the Architect and/or Construction Manager may impose in connection with such materials and/or equipment, including but not limited to insurance for such materials and cost of storage and transportation associated with such materials and/or equipment. No payment will be made for "commodity type" stored materials such as block, studs, sheetrock, roofing, insulation, piping, fittings, conduit work, etc.

2. In connection with materials and/or equipment stored off the project site, the Contractor must submit with its application for payment the following information:

- a. Type of material must be specifically identified by the Contractor;
- b. The Contractor must furnish an invoice from its supplier showing the total value of material and/or equipment being stored off site and must provide the bill of lading for such material and/or equipment;
- c. The Contractor must provide a Certificate of Insurance in a form approved by the Owner for the full value of the item plus 10%.
- d. The Contractor must execute a security agreement, together with an executed UCC-1 form;

- e. The materials must be stored in a bonded warehouse;
- f. The Contractor must furnish a bill of sale for stored material and/or equipment;

The Contractor still has liability for all materials whether paid or not until installed.

3. Any and all materials and/or equipment for which the Contractor has been paid shall be titled in the Owner upon installation by the Contractor and shall be stored in a bonded facility. For payment to be made to the Contractor, the Contractor must provide the Owner with a waiver of lien and general release from its supplier in connection with its provisions of such materials and/or equipment. Notwithstanding payment by the Owner, any and all warranties and/or guarantees required by this agreement shall not begin to run until the Contractor has completed all of its work.

4. Prior to payment by the Owner, the Contractor may be required to provide the Architect and the Construction Manager with an opportunity to visually inspect the materials and/or equipment for the purpose of determining that such materials are in fact in storage, are the materials specified for the Contractor's work and for any other purpose which the Owner, Construction Manager and/or Architect deem necessary for payment to be made to the Contractor.

F. If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to its agreement with the Owner, including but not limited to these General Conditions of the Contract for Construction, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained herein to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contractor's contract sum by an amount equal to that which the Owner is entitled.

G. The Contractor may not assign any monies due or to become due to it pursuant to its agreement with the Owner without the Owner's written consent. Any such assignment shall be in a form acceptable to the Owner. If the Contractor attempts to make such an assignment without such consent from the Owner, the Contractor shall nevertheless remain legally responsible for all obligations under its agreement with the Owner.

H. Progress payments and all other payments shall be made in accordance with Section 106 (b) of the General Municipal Law.

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I. At the same time the Contractor submits its insurance certificate to the Owner and the Construction Manager, it shall also submit to the Construction Manager the labor rates of each category of labor for which it and/or its subcontractors shall employ (either directly or indirectly). This information shall be itemized in the format shown below:

Contractor's Name					
Contractor's Address					
Contractor's Office Phone No.					
Contractor's Fax No.					
Contractor's Email Address					
Labor Rate Breakdown					
Worker's Title		Journeyman	1.5 Rate	Foreman	1.5 Rate
Base Hourly Rate					
Payroll Tax & Insurance:	% Per Hr.				
FICA					
Federal Unemployment					
State					
Workers Compensation					
Disability					
Other (Explanation Required)					
Subtotal					
Benefits:	\$ Per Hr.				
Vacation					
Health & Welfare					
Pension					
Annuity					
401(k) Fund					
Other (Explanation Required)					
Other (Explanation Required)					
Subtotal					
Hourly Labor Rate					

ARTICLE 10 INSURANCE REQUIREMENTS

A. The Contractor, at its sole cost and expense, shall provide the Owner with the following insurance coverage whether the operations to be covered thereby are through the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Workers' Compensation:

Coverage	Statutory
Extensions	Voluntary compensation All states coverage employers Employer's liability - unlimited

2. Commercial General and Umbrella Liability

Coverage	Occurrence using ISO occurrence Form CG 00 01 07 98 or later form
Limits per project	General Aggregate - \$2,000,000.00 Products - Completed/Operations - \$1,000,000.00 Personal & Advertising Injury - \$1,000,000.00 Fire Damage (any one fire) - \$50,000.00 Medical Expenses (any one person) - \$10,000.00 Umbrella - \$10,000,000.00

3. Automobile Liability (all vehicles
hired or non hired) \$1,000,000.00 per accident

4. If this project requires the removal of asbestos and/or hazardous materials, Contractors shall provide hazardous material liability insurance as follows:

\$1,000,000 per occurrence/\$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. If a retroactive date is used, it shall pre-date the inception of the Contract. If motor vehicles are used for transporting hazardous materials, the Contractor shall provide pollution liability broadened coverage (ISO endorsement CA 9948) as well as proof of MCS 90. Coverage shall fulfill all requirements of this Article 10 and shall extend for a period of three (3) years

following acceptance by the District of the Certificate of Completion.

5. Testing Company Errors and Omission Insurance

\$1,000,000 per occurrence/\$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the contract with the Owner.

If written on a "claims-made" basis, the retroactive date must pre-date the inception of the contract or agreement. Coverage shall remain in effect for two years following the completion of work. The testing company shall also provide proof of Workers' Compensation and NY State Disability Benefits Insurance, Commercial General Liability and Excess Liability with limits of \$2,000,000 each occurrence and in the aggregate.

Coverages shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment.

B. The insurance required to be procured by the Contractor pursuant to paragraph A of this Article 10 shall be purchased from and maintained by an insurance carrier licensed to do business in the State of New York, with an A.M. Best rating of "secured" or better. The Contractor must submit the Certificate of Insurance to the Architect or Construction Manager for the Owner's approval prior to the commencement of any work.

C. All insurance coverage to be provided by the Contractor pursuant to paragraph A of this Article 10 shall include a cancellation notice to the Owner of at least thirty days.

D. All insurance coverage to be provided by the Contractor shall name the Owner, the Construction Manager and the Architect as additional insureds on the policy. Additionally, the insurance coverage to be provided by the Contractor pursuant to paragraph A of this Article 10 shall state that the Contractor's coverage shall be the primary coverage for the Contractor's work.

E. In the event that any of the insurance coverage to be provided by the Contractor to the Owner contains a deductible, or the insurance provided by the Owner contains a deductible, the Contractor shall indemnify and hold the Owner, the Architect and the Construction Manager harmless from the payment of such deductible, which deductible shall in all circumstances remain the sole obligation and expense of the Contractor.

F. The Contractor acknowledges that its failure to obtain or keep current the insurance coverage required by paragraph A of this Article 10 shall constitute a material breach of contract and subjects the Contractor to liability for damages, including but not limited to

direct, indirect, consequential, special and such other damages the Owner sustains as a result of such breach. In addition, the Contractor shall be responsible for the indemnification to the Owner, Architect and Construction Manager, of any and all costs associated with such lapse in coverage, including but not limited to reasonable attorney's fees.

G. The Contractor shall require all subcontractors to carry similar insurance coverages and limits of liability as set forth in paragraph A of this Article 10 and adjusted to the nature of subcontractors' operations and submit same to the Owner for approval prior to start of any work. In the event the Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the Owner, Architect, Engineers, Construction Manager, Consultants, and Sub-consultants and their agents or employees from any and all claims for which the required insurance would have provided coverage. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.

H. The Contractor assumes responsibility for all injury or destruction of the Contractor's materials, tools, machinery, equipment, appliances, shoring, scaffolding, false and form work, and personal property of Contractor's employees from whatever cause arises. Any policy of insurance secured covering the Contractor or Subcontractors leased or hired by them and any policy of insurance covering the Contractor or Subcontractors against physical loss or damage to such property shall include an endorsement waiving the right of subrogation against the Owner for any loss or damage to such property.

J. The Owner in good faith may adjust and settle a loss with the Contractor's insurance carrier.

K. Before commencement of its work, the Contractor shall obtain and pay for such insurance as may be required to comply with the indemnification and hold harmless provisions outlined under Article 12 of these General Conditions of the Contract for Construction.

L. Review and acknowledgment of the Certificate of Insurance by the Owner, Construction Manager or the Architect shall not relieve or decrease the liability of the Contractor hereunder.

M. If the terms of policies expire, or the lives of the insurance companies terminate, before the Contract is completed or during the period of completed operations coverage, and the Contractor fails to maintain continuance of such insurance, the Owner is entitled to provide protection for himself, to pay premiums, and to charge the cost to the Contractor.

ARTICLE 11
REQUIRED BONDS FOR THE PROJECT

- A. The Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the State of New York.
- B. All Surety companies are subject to the approval of the Owner and may be rejected by the Owner without cause.
- C. Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment.
- D. Bonds shall be executed by a responsible surety licensed to do business in New York with an A.M. Best Rating of "A-" or better as to Policy Holder Ratings, and "VII" or better as to "Financial Size Category." Such bonds shall remain in effect for a period not less than two (2) years following final completion of the work by the Contractor.
- E. Bonds shall further be executed by a surety that is currently listed on the U.S. Treasury Department Circular 570 entitled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies," as amended.
- F. The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to 100% of the Contract Sum. The value of each bond shall be adjusted during the Project construction period to reflect changes in the Contract Sum.
- G. Every Bond must display the Surety's Bond Number.
- H. Each bond must be accompanied by an original Power of Attorney, giving the names of Attorneys-in-fact, and the extent of their bonding capacity.
- I. A rider including the following provisions shall be attached to each Bond:
1. Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.
 2. Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying

said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first class postage prepaid, to Lender and the Owner.

J. The Contractor shall deliver the required bonds to the Owner prior to beginning construction activity at the site, but no later than 10 days of issue date of Notice of Award of Contract. Said bonds shall be in the form set forth in the Project Manual. No work shall be performed by the Contractor until such bonds have been reviewed and approved.

K. The Owner may, in the Owner's sole discretion and without prior notice to the Contractor, inform surety of the progress of the Contractor's work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Contractor's work.

L. If the surety on any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of this Article, the Contractor shall within ten (10) days thereafter substitute another Performance and Payment Bond and surety, both of which must be acceptable to the Owner.

ARTICLE 12 INDEMNIFICATION

A. The Contractor and its subcontractors shall indemnify and hold harmless the Owner, Architect, and Construction Manager, and all their employees, agents or servants or any third parties from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses, including but not limited to attorneys' fees, which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any of its subcontractors or any person or firm directly or indirectly employed by such Contractor, for the act(s) and/or omission(s) of any Contractor or Subcontractor in connection with the work of the Project.

B. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, Construction Manager 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 its work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction, of tangible property including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed

by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph B. The Contractor's indemnity obligations under this Paragraph B shall, but not by way of limitation, specifically include all claims and judgments which may be made against the Owner, the Architect, the Architect's consultants and agents and employees of any of them under any applicable statute, rule or regulation including the New York Statute, Occupational Safety and Hazardous Act, and the Federal Occupational Safety and Hazardous Act. In claims against any person or entity indemnified under this Paragraph B by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph B shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The Contractor shall be liable for and shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder which are incurred as a result of the Contractor's failure to give the notices of these General Conditions of the Contract for Construction.

D. The Contractor shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any actions, lawsuits or proceedings or claims of liens brought against each or any of them as a result of liens filed against the Contractor's project funds, including all the cost and expense of said liens, and including but not limited to attorneys' fees incurred by each or any of them.

E. The Contractor shall indemnify and hold harmless the Owner, the Architect and the Construction Manager of and from any and all liability for violation of any laws and regulations applicable to the Contractor's work and shall defend any claims or actions which may be brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

F. The Contractor shall indemnify and hold harmless the Owner and the Architect of and from any and all liability for claims made by third parties, including subcontractors, in connection with this Agreement and shall defend any claims or actions which may be

brought against the Owner as the result thereof. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

ARTICLE 13 TIME FOR COMPLETION OF WORK

A. The date of commencement of the Contractor's work shall be as indicated in the agreement between the Contractor and the Owner. The date shall not be postponed or extended by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible to act. Time limits stated in the agreement between the Owner and the Contractor are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

B. The Contractor shall not commence work on the site until two certified copies of all insurance policies and bonds required by Article 10 and Article 11 of these General Conditions of the Contract for Construction are provided to the Owner and accepted by the Owner. The date of commencement and/or completion of the Contractor's work shall not be changed by the effective date of such insurance. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the acceptance of the insurance and bonds required by Article 10 and Article 11 of these General Conditions.

C. The Contractor shall proceed expeditiously with adequate forces and shall achieve substantial completion of its contract in accordance with the schedule set forth in its agreement. The Contractor shall cooperate with the Owner, Architect, Construction Manager, and other Contractors on the Project, making every reasonable effort to reduce the contract time.

D. 1. In the event the Owner determines that the performance of the Contractor's work, as of a milestone date, has not progressed or reached the level of completion required by its contract, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities and (3) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the Contractor progresses its work in compliance with the stage of completion required by its agreement with the Owner. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

2. The Contractor shall not be entitled to an adjustment in its contract sum in connection with Extraordinary Measures ordered by the Owner under or pursuant to this Paragraph D.

3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph D as frequently as the Owner deems necessary to ensure that the Contractor's performance of its work will comply with any Milestone Date or completion date set forth in the Contractor's agreement with it.

4. The Owner reserves the right to withhold payment from the Contractor until such time as the Contractor submits a daily schedule showing work to be again on schedule with the Construction Schedule and/or until its work is being installed according to the project construction schedule, without additional cost to the Owner.

E. The Contractor shall achieve substantial completion of its work in accordance with the schedule for the work set forth in the project manual included as part of its agreement with the Owner. Milestone Dates are dates critical to the Owner's operations that establish when a part of the work is to commence or be complete. All Milestone Dates are of the essence and shall have the same meaning as Substantial Completion for the purpose of Liquidated Damages in this Article 13.

F. Substantial completion shall be achieved by the Contractor when the Contractor has completed ninety eight (98%) of its work. Work remaining to be completed after substantial completion shall be limited to items which can ordinarily be completed within the period between the payment at the time of substantial completion and final payment.

G. 1. This project is to be physically completed in accordance with the time limits set forth in the agreement between the Owner and Contractor and as further set forth in the project manual and/or bidding documents. Liquidated damages will be assessed in the amount of \$1,000.00 for each and every calendar day after such time allowed for completion.

2. Contractor realizes that time is of the essence on this Contract and the completion date and milestone date for each work item in its agreement, a Milestone Date reflected on the project schedule, or the date of substantial completion of the Contractor's work shall be no later than the date indicated therein. In the event the Contractor fails to complete any work or substantially complete the work under this contract by said schedule date, the sum per calendar day for each date not met, as delineated above, will be subtracted from the payment due the Contractor (or, if the amount due Contractor as payment is insufficient, any deficiency shall be paid by the Contractor to the Owner), except in cases where the Contractor has applied for and been granted an extension of time in accordance with the provisions of this Article 13.

3. The said sum per calendar day shall constitute the Liquidated Damages incurred by the Owner for each day of delay beyond the agreed upon dates of Substantial Completion. Such Liquidated Damages shall be in addition to any other damages (other than by reason of delay) Owner may incur as a result of Contractor's breach of Contract. In

the event that substantial completion of its work is not achieved in accordance with the project schedule, inspections will be performed once each week unless the Owner or the Architect determines, at their sole discretion, that additional inspections are not needed. All costs incurred by the Owner, Owner's Representative and the cost of additional inspections, at the rate of One Thousand Dollars (\$1,000) per inspection, will be subtracted from payment due the Contractor. If the amount due the Contractor for payment is insufficient, any deficiency shall be paid by the Contractor to the Owner.

H. 1. Within five (5) calendar days from the occurrence of same, the Contractor must apply in writing to the Owner, its Architect or Construction Manager for an extension of time to complete its work where it has been delayed as a result of: unforeseeable causes beyond the control and without the fault or negligence of the contractor, including acts of God, acts of the public enemy, acts of the federal or state government in either their sovereign or contractual capacities, fires, floods, epidemics, quarantine restrictions, priority or allocation orders duly issued by the federal government; freight embargoes; changes in the work to be performed by the Contractor. The Contractor may not apply for an extension of time for delays in acquisitions of materials other than by reason of freight embargoes. All other delays of the project, including but not limited to, Architect review and/or approval of shop drawings and/or submittals, requests for information, clarifications, samples, and change orders; Owner schedule; Architect certification of payment; payment by Owner of Contractor's Application for Payment; coordination amongst Contractors; unavailability of materials and/or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and, therefore shall not form the basis for a claim for an extension of time by the Contractor.

2. All claims for additional time shall be supported by documentation which demonstrates to the Architect and Construction Manager's satisfaction that the Critical path of the Work has been significantly altered by the delays to the activities in question, and that the schedule cannot be maintained by re-ordering other activities within the project at no cost. Upon receipt of the Contractor's request for an extension of time, the Owner will ascertain the facts and extent of the delay, and may, in its sole discretion, extend the time for completion of the Contractor's work when in its judgment such an extension is justified. The Owner's determination will be final and binding in any litigation commenced by the Contractor against the Owner which arises out of the Owner's denial of an extension of time to the Contractor. Any approval of an extension of the Contractor's time to complete its work shall be memorialized by written change order, signed by the Owner, Contractor, Architect and Construction Manager. Where the Owner determines that the Contractor will be granted an extension of time, such extension shall be computed in accordance with the following:

For each day of delay in the completion of its work, the Contractor shall be allowed one day of additional time to complete its contract. The Contractor shall not be entitled to receive a separate extension of time for each one of several

causes of delay operating concurrently; only the actual period of delay as determined by the Owner or its Architect may be allowed.

3. Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under subparagraph H of this Article 13, shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity or acceleration; or (4) other similar claims (collective referred to herein as "delay(s)"), unless a delay is caused by the Owner's active interference with the Contractor's performance of the Work, and only to the extent such acts continue after the Contractor furnishes the Owner with three (3) days' written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any Delay, including, but not limited to, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, but not limited to, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as active interference with the Contractor's performance of the Work.

ARTICLE 14

DEFICIENT AND INCOMPLETE WORK

A. The Architect will have the authority to reject work performed by the Contractor which does not conform to the requirements of the drawings and/or specifications.

B. The Architect shall have the authority to require additional inspection or testing of the Contractor's work whether or not such work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the work to have performed additional inspection or testing of the work.

C. 1. If a portion of the Contractor's work is covered contrary to the Architect's request or to requirements specifically expressed in the drawings and/or specifications, upon request by the Architect or the Construction Manager, the Contractor shall uncover such work for the Architect's or any governmental authority's observation and be replaced at the Contractor's sole expense without change in the Contract Time or Contract Sum.

2. If a portion of the Contractor's work has been covered which the Architect or any governmental authority has not specifically requested to observe prior to its being covered, the Architect or any governmental authority may request to see such work and it shall be

uncovered by the Contractor. If such work is in accordance with the drawings and/or specifications, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor, at its sole cost and expense, shall uncover and replace such work.

D. The Contractor shall promptly correct work rejected by the Architect or failing to conform to the requirements of its contract with the Owner, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the all costs of correcting such rejected work, including but not limited to the cost of said additional testing and/or inspection, the cost of the Architect's services incurred in conjunction with such additional testing, and any cost, loss or damages to the Owner resulting from such actions. If prior to the date of Substantial Completion, the Contractor, a Sub-contractor or anyone for whom either is responsible uses or damages any portion of the Work or premises, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

E. If the Contractor (1) fails to correct work which is not in accordance with the requirements of its agreement with the Owner, or (2) fails to carry out its work in accordance with the requirements of its agreement with the Owner, or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the work within the contract time, or (4) fails to remove and discharge (within ten (10) days) any lien filed upon Owner's property by anyone claiming by, through, or under the Contractor, or (5) disregards the instructions of the Architect, Owner or Construction Manager, the Construction Manager, on behalf of the Owner may order the Contractor to stop its work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. This right shall be in addition to, and not in restriction of, other rights the Owner may have pursuant to these General Conditions or at law.

F. 1. If the Contractor defaults or neglects to carry out its work in accordance with its agreement with the Owner and fails within a three (3) day period after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect, the Construction Manager and the Owner and such other consultants whose participation is deemed necessary by the Architect, for additional services and expenses made necessary by such default, neglect or failure. Such action by the Construction Manager, including the amounts to be charged to the Contractor as a result of such action

are subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2. Where the Contractor's default and/or neglect to carry out its work in accordance with its agreement with the Owner threatens the health, safety and/or welfare of the occupants of the school district's facilities and/or threatens the structural integrity and/or preservation of the school district's facilities, the Owner may proceed to carry out the Contractor's work upon twenty-four (24) hours notice of its intention to do so to the Contractor.

G. If the Owner prefers to accept work which is not in accordance with the terms and conditions of the agreement between the Owner and the Contractor, the Owner may, in its discretion, accept such work and reduce the Contractor's contract sum accordingly.

ARTICLE 15

FINAL COMPLETION AND CLOSEOUT OF THE PROJECT

A. 1. When advised by the Construction Manager that the Contractor's work is near substantial completion, the Architect shall visit the site to determine whether the Contractor's work is substantially complete. If the Architect's observations of the Contractor's work discloses any item which has not been performed in accordance with the requirements of the drawings and/or specifications and/or which has not been completed to the point indicated in Article 13 paragraph F of these General Conditions, the Contractor shall complete or correct such items upon receipt of notification from the Architect that a deficiency exists. The Architect shall not issue a certificate of substantial completion for the work of the Contractor until the work has been completed in accordance with Article 13(F). Upon completion of the work outlined by the Architect to it in accordance with this paragraph A, the Contractor shall advise the Architect of the need for an inspection of the work. If the Architect is required to inspect the Contractor's work more than twice, the Contractor shall be liable to the Owner for the services performed by the Architect as a result of additional inspections.

2. Upon determining that the Contractor's work has progressed to the point of Substantial Completion, the Architect shall prepare a punch list of the Contractor's work which shall include only minor items of work remaining to be performed by the Contractor to bring its work into compliance with the requirements of the drawings and/or specifications. The Contractor shall proceed promptly to complete and correct items on the punch list issued by the Architect and shall complete said items within thirty (30) days of its receipt of the punch list from the Architect. At the time of substantial completion, the Owner shall retain 200 percent of the value of the punch list items from the Contractor's remaining contract sum. The value of said remaining work shall be determined by the Architect. Upon completion of the work reflected in the final punch list, the Owner shall release the monies withheld pursuant to this paragraph to the Contractor.

3. The Architect's failure to include an item of deficiency on the punch list issued to the Contractor shall not relieve the contractor of its responsibility to perform its work in accordance with the drawings and/or specifications.

B. 1. If within two (2) years after the date of Substantial Completion of the Contractor's work or designated portion thereof, or after the date for commencement of warranties established pursuant to these General Conditions, or by terms of in applicable special warranty required by the agreement between the Owner and the Contractor, any of the Work is found to be not in accordance with the requirements of said agreement, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of two (2) years shall be extended with respect to portions of the Contractor's work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of such work. The obligation set forth hereunder shall survive acceptance by the Owner of the Contractor's and/or termination of the Contractor's agreement with the Owner. The Owner shall give such notice within a reasonable period of time after discovery of the condition.

2. The Contractor shall, within a reasonable time after receipt of written notice thereof, but in no event no later than seventy-two (72) hours after receipt of such notice, commence to correct, repair, and make good any defects in its work.

3. The obligations of the Contractor pursuant to this paragraph shall cover any repairs to or replacement of work affected by the defective work.

4. In the case of any work performed in correcting defects pursuant to this paragraph, the guarantee periods specified herein shall begin anew from the date of acceptance by the Owner of such work.

C. Upon receipt of written notice from the Construction Manager that the Contractor's work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Contractor's work acceptable pursuant to the terms and conditions of its agreement with the Owner and the Contract fully performed and upon receipt of the closeout documentation required by the Contract Documents and elsewhere in the agreement between the Owner and the Contractor, the Architect will certify to the Owner that the Contractor is entitled to final payment on the project.

D. 1. Prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.

2. The Contractor shall schedule a close out meeting with the Architect and the Construction Manager for the purpose of delivering the close out documents required

pursuant to the Contract Documents and elsewhere in the agreement between the Owner and the Contractor.

E. If the Contractor's work is not accepted by the Owner after final inspection and additional time is required to complete items identified during the final inspection, the date starting the warranty periods described in the Contract Documents shall be set by the Architect at his discretion.

F. If the Architect is required to perform more than one final inspection because the Contractor's work fails to comply with the requirements of the contract, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the final payment to the Contractor.

G. Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those claims previously made in writing in accordance with the terms of Article 18 hereof and identified by that payee as unsettled at the time of final Application for Payment.

H. Contractor shall submit all documentation identified in this section within ninety (90) days from the date of Substantial Completion. If the documentation has not been submitted, the Owner will obtain same through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner in securing such documentation.

ARTICLE 16

RELEVANT STATUTORY PROVISIONS

A. The Contractor shall at all times observe and comply with all Federal and State Laws and all Laws, Ordinances and Regulations of the Owner, in any manner affecting the work and all such orders decreed as exist at present and those which may be enacted later, by bodies or tribunals having jurisdiction or authority over the work, and the Contractor shall indemnify and save harmless the Owner and all his officers, agents, or servants against any claim or liability arising from, or based on, a violation of any such law, ordinances, regulation, order or decree, whether by himself or by his employee or agents.

B. The Contractor and each of its subcontractors shall comply with Prevailing Wage Rates as issued by the State of New York Department of Labor for the location and duration of this Project and shall comply with all requirements governing its payments to its employees as set forth in Labor Law, section 220 et seq of the New York State Labor Law, as amended.

C. The Contractor and each of its subcontractors shall post a notice at the beginning of the performance of every public work contract on each job site that includes the telephone

number and addresses for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her particular job classification.

D. The Contractor specifically agrees, as required by Labor Law, Sections 220 and 220-d, as amended, that:

1. No laborer, workman or mechanic in the employ of the Contractor, subcontractor or other person doing or contracting to do the whole or any part of the work contemplated by the Contract, shall be permitted or required to work more than eight hours in any one calendar day or more than five days in any one week, except in the emergencies set forth in the Labor Law.
2. The wages paid for a legal day's work shall not be less than the prevailing rate of wages as defined by law.
3. The minimum hourly rate of wages to be paid shall not be less than that stated in the Project Manual, and any re-determination of the prevailing rate of wages after the Contract is approved shall be deemed to be incorporated herein by reference as of the effective date of re-determination and shall form a part of this Contract. The Labor Law provides that the Contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:
 - a. The stipulated wage scale as provided in Labor Law, Section 220, Sub division 3, as amended; or
 - b. The stipulated minimum hourly wage scale as provided in Labor Law, Section 220-d, as amended.

E. The Contractor acknowledges that its work is governed by the provisions of Section 101 of the General Municipal Law of the State of New York.

F. The Contractor specifically agrees, as required by the provisions of the Labor Law of New York, Section 220-E, as amended that:

1. In the hiring of employees for the performance of this contract or any sub-contractor hereunder, no contractor, sub-contractor, nor any person acting on behalf of such contractor or sub-contractor shall by reason of race, creed, color or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates.

2. No contractor, sub-contractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, color, creed, sex or national origin.
3. There may be deducted from the amount payable to the Contractor a penalty of fifty dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract.
4. This Contract may be canceled or terminated by the Owner and all monies due or to become due hereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

The aforesaid provisions of this section covering every Contract for or on behalf of the Owner, the State or a municipality for the manufacture, sale or distribution of materials, equipment or supplies shall be limited to operations performed within the territorial limits of the State of New York.

G. The successful Contractor shall conform to the guidelines spelled out in the County's Affirmative Action Program, if any.

H. The Contractor shall comply with all of the provisions of the Immigration Reform and Control Act of 1986 and regulations promulgated pursuant thereto and shall require its subcontractors to comply with same. The Contractor shall and does hereby agree to fully indemnify, protect, defend, and hold harmless the Owner, Owner's agents and employees from and against any penalties, fees, costs, liabilities, suits, claims, or expenses of any kind or nature, including reasonable attorney's fees, arising out of or resulting from any violation or alleged violation of the provisions of said laws in connection with the work performed hereunder.

I. This Contract shall be void if the Contractor fails to install, maintain, and effectively operate appliances and methods for the elimination of harmful dust when a harmful dust shall have been identified in accordance with Section 222-a of the Labor Law of the State of New York.

J. The Contractor shall insure that absolutely no asbestos containing material is used in conjunction with the performance of its work. The Contractor bears the sole responsibility to provide assurances that no asbestos containing material is built into the construction, or that any equipment used in the construction contains any asbestos containing material. If asbestos containing material is found, at any time during or after the construction is completed, it shall be the responsibility of the Contractor who installed said material to remove it and replace it with new non-asbestos containing material, as per federal, state and local mandates.

K. Large and small asbestos abatement projects as defined by 12 N.Y.C.R.R. 56 shall not be performed while the building is occupied. As referenced in this section, the term "building" shall mean a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion, and ventilation systems must be physically separated and sealed at the isolation barrier. Exterior work such as roofing, flashing, siding or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and windows is provided. Work must be scheduled so that classes are not disrupted by noise or visual distraction.

L. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD Guidelines.

M. No smoking is allowed anywhere on school property per New York State and County law. Violators are subject to a \$1,000 fine and/or banishment from the property.

N. Applicable codes and standards for material furnished and work installed shall include all state laws, local ordinances, requirements of governmental agencies having jurisdiction, and applicable requirements of following codes and standards, including but not limited to:

1. New York State Uniform Fire Prevention and Building Code, and amendments thereto.
2. New York State Energy Conservation Construction Code.
3. State Education Department Manual of Planning Standards.
4. New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials, latest edition.
5. Life Safety Code - NFPA.

O. Wherever in the specifications reference is made to ANSI or ASTM Standards, Federal Specifications, Consumer Product Standards, or similar recognized standards, the latest edition of the respective publishing agency in effect at the date of "Bid Issuance" shall be accepted as establishing the technical requirements for which compliance is required.

P. The Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of its agreement in the event (1) an order for relief is entered on behalf of the Contractor pursuant to Title 11 of the United States Code, (2) any other similar order is entered under any other debtor relief laws, (3) the Contractor makes a general assignment for the benefit of its creditors, (4) a receiver is appointed for the benefit of its creditors, or (5) a receiver is appointed on account of its insolvency. Failure to comply with such request within ten (10) days of delivery of the request shall entitle the Owner to terminate the Contract in accordance with Article 17 hereof. In all events, pending receipt of adequate assurance of performance and actual performance in accordance therewith, the Owner shall be entitled to proceed with the Contractor's work with its own forces or with other contractors on a time and material or other appropriate basis, the cost of which will be back charged against the Contractor.

Q. The Contractor shall maintain policies of employment as follows:

1. The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

2. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

ARTICLE 17

TERMINATION OR SUSPENSION

A. 1. The Owner may terminate the Contractor's agreement in the event the Contractor:

- a. refuses or fails to supply sufficient skilled workers or suitable materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;
- b. refuses or fails to correct deficient work performed by it;

- c. fails to make prompt payments to subcontractors for labor, materials, and/or equipment in accordance with the respective agreements between the Contractor and the Subcontractors;
- d. disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;
- e. disregards the instructions of the Architect, Construction Manager or the Owner (when such instructions are based on the requirements of the Contract Documents);
- f. is adjudged a bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act or to reorganize under bankruptcy or similar laws; or
- g. breaches any warranty made by the Contractor under or pursuant to the Contract Documents.
- h. fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents; or
- i. fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents.
- j. fails to keep the Project free from strikes, work stoppages, slowdowns, lockouts or other disruptive activity;
- k. or otherwise does not fully comply with the Contract Documents.

2. When any of the above reasons exists, may without prejudice to any other rights or remedies of the Owner, terminate employment of the Contractor upon three (3) days written notice and may, subject to any prior rights of the surety:

- a. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- b. take possession of materials stored off site by the Contractor;

- c. take assignments of the Contractor's subcontractors in accordance with these General Conditions;
- d. finish the Work by whatever reasonable method the Owner may deem expedient.

3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 1 hereof, the Contractor shall not be entitled to receive further payment until the completion of the Contractor's work. If the Owner's costs to complete the Contractor's work, including the expenses incurred by the Owner in connection with the services of the Architect, the Construction Manager and/or other consultants, exceed the contract balance remaining on the Contractor's contract, the Contractor shall be liable to the Owner for such excess costs. This provision shall survive termination of the Contractor's agreement with the Owner.

4. In the event a court or other tribunal issues a final determination that Owner's termination for cause was arbitrary, capricious or otherwise without cause and/or reverses Owner's termination for cause, such termination shall, without further action on the part of Owner, be converted to a termination for convenience, as set forth in (B), below.

B. 1. In addition to the Owner's right to carry out the work of the Contractor pursuant to its agreement with the Contractor, the Owner may at any time, at will and without cause, terminate any part of the Contractor's work or all of the Contractor's remaining work for any reason whatsoever by giving three (3) days' written notice to Contractor, specifying the portion of the Contractor's work to be terminated and the effective date of termination.

2. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

- a. cease operation as specified in the notice;
- b. place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract;
- c. terminate all subcontracts and orders to the extent they relate to the Work terminated;
- d. proceed to complete the performance of the remaining work on its contract which has not been so terminated; and
- e. take actions that may be necessary, or that the Owner may direct, for

the protection and preservation of the terminated Work.

3. The Contractor shall continue to prosecute that portion of its work which has not been terminated by the Owner pursuant to this paragraph. If the Contractor's work is so terminated, the Owner shall not be liable to the Contractor by reason of such termination except that the Contractor shall be entitled to payment for the work it has properly executed in accordance with its agreement and prior to the effective date of termination (the basis for such payment shall be as provided in the Contract) and for costs directly related to work thereafter performed by Contractor in terminating such Work, provided such work is authorized in advance by the Architect and the Owner. No payment shall be made by Owner, however, to the extent that such work is, was, or could have been terminated under the Contractor's agreement with the Owner.

4. In case of a termination pursuant to this paragraph B, the Owner will issue a Construction Change Directive or authorize a Change Order, making any required adjustment to the Date of Substantial Completion and/or the sum of contract monies remaining to be paid to the Contractor. The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work, (2) claims which the Owner has against the Contractor under the Contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum; multiplied by 15% representing the Contractor's overhead and profit.

5. For the remaining portions of the Contractor's work which have not been terminated pursuant to this paragraph B, the terms and conditions of the Contractor's agreement with the Owner shall remain in full force and effect.

6. Upon termination of the Contractor's work or a portion of the Contractor's work pursuant to this paragraph B, the Contractor shall recover as its sole remedy, payment for work which it has properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, overhead and profit related to work terminated by the Owner pursuant to this paragraph B.

C. 1. In addition to Owner's right to suspend, delay, or interrupt Contractor from proceeding with any portion of its work pursuant to the terms and conditions of its agreement with the Owner, the Owner may at any time, at will and without cause suspend, delay, or interrupt any part of the Contractor's work or all work for any reason whatsoever for such period of time as the Owner may determine by giving three (3) days' prior written notice to Contractor, specifying that portion of the Contractor's work which is to be suspended, delayed, or interrupted, and the effective date of such suspension, delay, or interruption, as the case may be.

2. The Contractor shall continue to prosecute that portion of its work which has not been suspended, delayed, or interrupted, and shall properly protect and secure the portion of its work so suspended, delayed or interrupted.

3. The Owner shall incur no liability to Contractor by reason of such suspension, delay, or interruption except that Contractor may request an extension of its time to complete its work in accordance with Article 13 hereof.

D. The Contractor agrees and acknowledges that payments for the work have been obtained through obligations or bonds which have been sold after public referendum. In the event the work is suspended or canceled as a result of the order of any court, agency, department entity or individual having jurisdiction, or in the event the work is suspended or canceled due to the fact that a court, agency, department, entity or individual having jurisdiction has issued an order, the result of which is that the aforesaid obligations or bonds are no longer available for payment for the work, the Contractor expressly agrees that it shall be solely entitled to payment for work accomplished until a notice of suspension or cancellation is served upon it. The Contractor expressly waives any and all rights to institute an action, claim, cause of action or similar for any damages it may suffer as a result of the suspension or cancellation of the Work and/or its contract pursuant to this section.

ARTICLE 18 CLAIMS AND DISPUTES

A. Definition. A "Claim" is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract.

B. Time Limits on Claims. Claims by the Contractor must be made within thirty (30) days after occurrence of the event giving rise to such Claim, or within thirty (30) days after the claimant first recognizes the condition giving rise to the Claim, whichever is earlier. Claims must be made by written notice. An additional Claim made after the initial Claim has been decided by the Owner will not be considered unless submitted in a timely manner. Failure of the Contractor to give timely notice of claim shall constitute waiver of the claim. Claims must be made by written notice to the Construction Manager, Architect and Owner. The responsibility to substantiate Claims shall rest with the Contractor.

C. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

D. Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the Owner and Architect promptly before conditions are disturbed and in no event later than five (5) days after first observance of the conditions; and, (3) in the case of a condition at the site which involves a hazardous or toxic substance, as those terms are defined by OSHA or AHERA, notice to the Owner, the Construction Manager and the Architect shall be given immediately upon discovery of such hazardous or toxic substance. The Architect, and/or Construction Manager will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Contractor in writing, stating the reasons.

E. Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum as a result of a Change in the Work pursuant to Article 8 of these General Conditions, written notice as provided in this Article 18 shall be given before proceeding to execute the Work.

F. Claims for Additional Time. If the Contractor wishes to make Claim for an increase in the Contract Time, the Contractor shall comply with the requirements set forth in Article 13.

G. Nothing contained in the Contract Documents shall relieve a Contractor from compliance with any statutory requirement, including, but not limited to those contained in Education Law Section 3813.

ARTICLE 19 MISCELLANEOUS PROVISIONS

A. The agreement between the Owner and the Contractor shall be governed by the law of the place where the project is located; venue to be in the County in which the project is located.

B. Historical lack of enforcement of any law, local or otherwise, shall not constitute a waiver of Contractor's responsibility for compliance with such law in a manner consistent with its agreement with the Owner unless and until the Contractor has received written consent for the waiver of such compliance from the Owner and the Agency responsible for the enforcement of such law.

C. All notices to be given hereunder shall be in writing and may be given, served, or made (1) by depositing the same for first class mail delivery in the United States mail addressed to the authorized representative of the party to be notified; (2) by depositing the same in the United States mail addressed to the authorized representative of the party to be notified, postpaid and registered or certified with return receipt requested; (3) by depositing the same for overnight delivery (prepaid by or billed to the party giving notice) with the United States Postal Service or other nationally recognized overnight delivery service addressed to the authorized representative of the party to be notified; or (4) by delivering the same in person to the said authorized representative of such party. Notice deposited in the mail by certified mail or overnight delivery in accordance with the provisions hereof shall be effective from and after the fourth (4th) day next following the date postmarked on the envelope containing such notice, or when actually received, whichever is earlier. All notices to be given to the parties hereto shall be sent to or made at the addresses set forth hereinbelow. By giving the other parties at least seven (7) days' written notice thereof, the parties hereto shall have the right to change their respective addresses and specify as their respective addresses for the purposes hereof any other address in the United States of America.

D. Except as expressly provided in the agreement between the Owner and the Contractor, duties and obligations imposed by such agreement and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law, or in equity or by other agreement, and such rights and remedies shall survive acceptance of the Contractor's work and/or any other termination of the Contractor's agreement with the Owner.

E. No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

F. The headings denoting the separately numbered Articles of these General Conditions are specifically set forth for reference purposes only and are not in any way to be deemed explanatory of or limiting of the contents of any paragraph or subparagraph. Furthermore, said headings are not to be deemed part of this Agreement for purposes of interpretation, litigation or as defining or limiting the rights or obligations of the parties.

G. In case any provision of this Agreement should be held to be contrary to, or invalid, under the law of any country, state or other jurisdiction, such illegality or invalidity, shall not affect in any way, any other provisions hereof, all of which shall continue, nevertheless, in full force and effect in any country, state or jurisdiction in which such provision is legal and valid.

H. The rights stated in these General Conditions and the documents which form the agreement between the Owner and the Contractor are cumulative and not in limitation of any rights of the Owner at law or in equity.

I. The Owner shall not be responsible for damages or for loss of anticipated profits on work not performed on account of any termination of the Contractor by the Owner or by virtue of the Owner's exercise of its right to take over the Contractor's work pursuant to its agreement with the Contractor.

J. The Owner shall not be liable to the Contractor for punitive damages on account of any its termination of the Contractor or any other alleged breach of the agreement between it and the Contractor and the Contractor hereby expressly waives its right to claim such damages against the Owner.

K. The Contractor hereby expressly waives any rights it may have in law or in equity to lost bonding capacity as a result of any of the actions of the Owner, the Architect or the Construction Manager taken in connection with the Contractor's work on the Project.

L. Upon determination by legal means (e.g. court action, etc.) that termination of Contractor pursuant to Article 17.A.1 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Article 17.B.1 and Contractor's remedy for such termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Article 17.B.1.

M. As between the Owner and Contractor:

1. Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

2. Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
3. After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to warranties provided in accordance with its agreement with the Owner, the date of any correction of work performed by the Contractor or failure to correct its work, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

N. 1. The Owner may occupy or use any completed or partially completed portion of the Contractor's work at any stage when such occupancy is authorized by public authorities having jurisdiction over the project.

2. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of the Contractor's work, nor does it waive the Owner's right to liquidated damages. Further such occupancy alone shall not determine when substantial completion and performance has been reached

3. Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Contractor's work, and in order to prepare a complete punchlist of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced.

O. The Contractor agrees not to assign, transfer, convey or sublet or otherwise dispose of this Contract or his right, title and interest therein or his power to execute such Contract, to any other person, firm or corporation without the previous consent in writing of the Owner.

P. The Owner is a tax exempt organization and will take title to materials used in the Project in order to permit tax exemption.

Q. The Owner will furnish a certificate with the Owner's Tax Exemption Number to the Contractor for use in purchasing tangible personal property required for the Project.

R. This exemption shall not apply to machinery, equipment, tools, and other items purchased, leased, rented, or otherwise acquired for the Contractor's use even though the machinery, equipment, tools or other items are used either in part or entirely on the Work. This exemption shall apply only to materials fully incorporated into the Work of the Contract as accepted and approved by the Architect.

S. The Contractor shall, upon request by the Owner, furnish a bill of sale or other instrument indicating the quantities and types of materials purchased directly by the Contractor or subcontractor for incorporation into the Work. Upon delivery of the materials to the site, the Contractor shall mark or otherwise identify the materials to be incorporated into the Work. This exemption shall apply only to materials so identified and accepted.

END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

SECTION 00 7250 - INSURANCE REQUIREMENTS – CONTRACTOR

1. Notwithstanding any terms, conditions or provisions, in any other writing between the parties, the contractor hereby agrees to effectuate the naming of the Ossining Union Free School District (District / Owner), Arris Contracting Co., Inc. (Construction Manager), and CPL (Architect/Engineer) as an Additional Insured on the contractor's insurance policies, except for workers' compensation and N.Y. State Disability insurance.
2. The policy naming Additional Insured(s) shall:
 - a. Be an insurance policy from an A.M. Best A- rated or better insurer, licensed to conduct business in New York State.
 - b. State that the organization's coverage shall be primary and non-contributory coverage for the District, its Board, employees and volunteers, Architect, and Construction Manager.
 - c. Additional insured status shall be provided by standard or other endorsements that extend coverage to the District, Architect, and Construction Manager for on-going operations (CG 20 38) and products and completed operations (CG 20 37). The decision to accept an endorsement rest solely with the District, and it's consultants. A completed copy of the endorsements must be attached to the Certificate of Insurance.
 - d. All insurance policies maintained by the Contractor shall include a waiver of any and all rights of subrogation of the Contractor or its insurers against the Owner, Architect and Construction Manager, along with all other Additional Insureds / Indemnified Parties and their agents, officers, directors and employees for recovery of damages. Contractor further waives its rights of subrogation against the Owner or any Additional Insureds or Indemnified Party for any damage or loss to the Contractor's scope of work, tools, equipment, materials or any other loss within the scope of any insurance maintained by the Owner.
3.
 - a. The certificate of insurance must describe the services provided by the contractor (e.g., roofing, carpentry or plumbing) that are covered by the liability policies.
 - b. The contractor shall provide a copy of the declaration page of the liability and umbrella/excess policies with a list of endorsements and forms. If requested, the contractor shall provide a copy of the policy endorsements and forms.
 - c. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACORD 855 2014/15) must be included with the certificates of insurance. For any "Yes" answers on Items G through L on this Form– additional details must be provided in writing.
4. The contractor agrees to indemnify the District for applicable deductibles and self-insured retentions.

5. Minimum Required Insurance:

a. **Commercial General Liability Insurance**

\$1,000,000 per Occurrence/ \$2,000,000 Aggregate

\$2,000,000 Products and Completed Operations

\$1,000,000 Personal and Advertising Injury

\$100,000 Fire Damage

\$10,000 Medical Expense

The general aggregate shall apply on a per-project basis.

8. **Owners Contractors Protective (OCP) Insurance**

For projects less than or equal to \$1,000,000 and work on 1 story (10 feet) only;

\$1 million per occurrence, \$2 million aggregate with the District as the Named Insured.

For projects greater than \$1,000,000 and work over 1 story (10 feet); \$2 million per occurrence, \$4 million aggregate with the District as the Named Insured.

The District will be the Named Insured on OCP Policies. There will be no Additional Insureds on any OCP Policies.

c. **Automobile Liability**

\$1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

8. **Workers' Compensation and NYS Disability Insurance**

Statutory Workers' Compensation (C-105.2 or U-26.3); and NYS Disability Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable. A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

8. **Builder's Risk**

Must be purchased by the contractor to include interest of the Owner and Contractor jointly in a form satisfactory to the Owner. The limit must reflect the total completed value – all material and labor costs and provide coverage for fire, lightning, explosion, extended coverage, vandalism, malicious mischief, windstorm, hail and/or flood.

f. **Umbrella/Excess Insurance**

\$5 million each Occurrence and Aggregate for general construction and no work at elevation greater than 1 story or 10 feet, or project values less than or equal to \$1,000,000.

\$10 million each Occurrence and Aggregate for high risk construction, work at elevation greater than 1 story or 10 feet, or project values greater than \$1,000,000.

Umbrella/Excess coverage shall be on a follow-form basis.

6. Contractor acknowledges that failure to obtain such insurance on behalf of the District constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the District. The contractor is to provide the District with a certificate of insurance, evidencing the above requirements have been met, prior to the commencement of work.
7. Sub-contractors are subject to the same terms and conditions as stated above and submit same to the District for approval prior to start of any work.
8. In the event the Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the District, its Board, employees and volunteers, Construction Manager, and the Architect/Engineer, from any and all claims for which the required insurance would have provided coverage. **This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.**

ADDITIONAL REQUIREMENTS ASBESTOS, LEAD ABATEMENT AND/OR HAZARDOUS MATERIALS

Asbestos/Lead Abatement Insurance

\$2,000,000 per occurrence/\$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement, enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. If a retroactive date is used, it shall pre-date the inception of the Contract.

If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall maintain pollution liability broadened coverage (ISO endorsement CA 9948), as well as proof of MCS 90. Coverage shall fulfill all requirements of these specifications and shall extend for a period of three (3) years following acceptance by the District of the Certificate of Completion.

Testing Company Errors and Omission Insurance

\$1,000,000 per occurrence/\$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the District.

END OF SECTION 00 7250

PREVAILING WAGE AGREEMENT

PRC NUMBER AND CERTIFIED PAYROLL

Project Title
Ossining Union Free School District
Ossining High School
3rd Floor Connector

Location
Ossining High School
29 S. Highland Avenue
Ossining, NY 10562

This is to inform you that the Prevailing Rate Case number (PRC #) issued by the DOL for the above project is **2021002446**.

With each application for payment a certified payroll must be submitted, in order to release payment for your services.

Section 220.3 of Article 8 of the New York State Labor Law requires “a provision that each laborer, workman or mechanic employed by the contractor, sub-contractor or other person about or upon such public work, shall be paid not less than the prevailing rate of wages and shall be provided supplements not less than the prevailing supplements as determined by the fiscal officer.”

ACCEPTANCE

Date

Name of Company

Authorized Officer

SECTION 00 7343-PREVAILING WAGE RATES

PART 1 - GENERAL

1.1 GENERAL

- A. Wage rates shall apply as shown in the Prevailing Wage Schedule prepared by the New York State Department of Labor for this project (the Prevailing Wage Case Number (PRC#) assigned to this project is **2021002446**. The Schedule can be viewed at the following web site <https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1510757>. Upon award of the Contract to the successful bidder, a hard copy of the Schedule will be provided.
- B. The Contractor shall be responsible for completing one copy of Notice of Contract Award (Form PW-16). Upon completion of the form, the Contractor shall submit the form to the Architect. Architect will forward a copy to the New York State Department of Labor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00 7343

SECTION - 011000

SUMMARY OF WORK – MULTIPLE PRIME CONTRACTS

PART I - GENERAL

1.1 PROJECT INFORMATION

- A. Project: Ossining High School Third Floor Connector Project
- B. Owner: Ossining Union Free School District. 400 Executive Blvd, Ossining NY
Owners Representative: Jared Mance
- C. Architect: Clark Patterson Lee: 50 Front Street Suite 202 Newburgh NY
- D. Construction Manager: Arris Contracting Company, Inc.
- E. The overall scope of work includes: Ossining High School ; abatement and selective demolition at existing building corridor locations, concrete FRP reinforcing, new steel framing/decking, cold form, roofing, windows , finishes, associated mechanical, electrical and roof drain upgrades.
 - 1. The contractors shall provide all labor, materials, equipment and services to furnish deliver and install all materials and related work as shown on the drawings, as required by these specifications and/or as directed by the Architect/Construction Manager.
- F. Contract:
 - 1. The Project will be constructed under a multiple prime-contracting arrangement.
 - 2. Prime Contacts are separate contracts between the Owner and separate contractors, representing significant construction activities. Each prime contact is performed concurrently with and closely coordinated with construction activities performed on the Project under other prime contracts. Prime contracts for this Project include.
 - a. Contract 1: General Work Contract (GC or GWC)
 - b. Contract 2: HVAC Contract (HVAC, HC or MC)
 - c. Contract 3: Electrical Contract (EC)

1.2 DIVISION OF WORK:

- A. Each Contract shall include all labor materials, plans, tools, equipment, and supervision which are required for or incidental to the proper completion of the work as indicated on the drawings and described in the following specification sections.

1.3 GENERAL REQUIREMENTS – ALL CONTRACTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 0110	TABLE OF CONTENTS
00 1112	ADVERTISEMENT FOR BID
00 2000	INSTRUCTIONS TO BIDDERS

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SECTION 00 11000 – SUMMARY OF WORK

00 11000

00 2010	GENERAL INSTRUCTIONS TO BIDDERS
00 3000	REQUESTS FOR CLARIFICATION OF BID DOCUMENTS
004010	FORM OF PROPOSAL – GENERAL CONSTRUCTION WORK
004020	FORM OF PROPOSAL – HVAC WORK
004030	FORM OF PROPOSAL – ELECTRICAL WORK
00 4510	ASBESTOS NOTIFICATION
00 4522	SEXUAL HARASSMENT PREVENTION FORM
00 4951	IRAN DIVESTMENT ACT CERTIFICATIONS
00 4960	BID PROPOSAL CERTIFICATIONS
00 4970	HOLD HARMLESS AGREEMENT
00 4980	INSURANCE CERTIFICATION FORM
00 5100	AGREEMENT FORM
00 6000	PROJECT FORMS
00 7100	GENERAL CONDITIONS
00 7250	INSURANCE REQUIREMENTS CONTRACTOR
00 7343	WAGE RATE REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 1000	SUMMARY OF WORK – MULTIPLE PRIME CONTRACTS
01 1100	MILESTONE SCHEDULE
01 2100	ALLOWANCES
01 2200	UNIT PRICES
01 2600	CONTRACT MODIFICATION PROCEDURES
01 2900	PAYMENT PROCEDURES
01 3100	PROJECT MANAGEMENT AND COORDINATION
01 3150	COVID-19 CONTRACTOR COMPLIANCE
01 3200	CONSTRUCTION PROGRESS DOCUMENTATION
01 3216	CONSTRUCTION PROGRESS SCHEDULE
01 3300	SUBMITTAL PROCEDURES
01 4000	QUALITY REQUIREMENTS
01 4119	REGULATORY REQUIREMENTS (NYS EDUCATION DEPARTMENT)
01 4120	WORK RESTRICTIONS
01 4200	REFERENCES
01 4533	STATEMENT OF SPECIAL INSPECTIONS AND TESTS
01 5000	TEMPORARY FACILITIES AND CONTROLS
01 6000	PRODUCT REQUIREMENTS
01 7300	EXECUTION
01 7310	CUTTING AND PATCHING
01 7423	CLEANING UP
01 7700	CLOSEOUT PROCEDURES
01 7823	OPERATION AND MAINTENANCE DATA
01 7839	PROJECT RECORD DOCUMENTS
01 7900	DEMONSTRATION AND TRAINING

1.4 CONTRACT #1 - GENERAL WORK CONTRACTOR (GWC OR GC)

- A. In addition to the General Requirements, Divisions 0 & 1, included in this bid package, contractor shall provide for proper completion of the work as indicated on all drawings and in accordance with the terms and conditions described in the following specification sections.

DIVISION 02 - EXISTING CONDITIONS

- 02 0800 ASBESTOS ABATEMENT PROCEDURES
- 02 4119 SELECTIVE REMOVAL
- 02 8300 LEAD SAFE WORK PRACTICES

DIVISION 03 - CONCRETE

- 03 0131 STRENGTHENING OF CAST-IN-PLACE CONCRETE
- 03 3000 CAST-IN-PLACE CONCRETE

DIVISION 04 - MASONRY

- 04 0215 THIN BRICK PANEL SYSTEM
- 04 2000 UNIT MASONRY

DIVISION 05 – METALS

- 05 1200 STRUCTURAL STEEL FRAMING
- 05 3100 STEEL DECKING
- 05 4000 COLD FORMED METAL FRAMING
- 05 5000 METAL FABRICATIONS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

- 06 4023 INTERIOR ARCHITECTURAL WOODWORK

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

- 07 2100 THERMAL INSULATION
- 07 4216 INSULATED WINDOW PANELS
- 07 5320 EPDM ROOFING
- 07 6200 SHEET METAL FLASHING AND TRIM
- 07 7100 ROOF SPECIALTIES
- 07 8413 PENETRATION FIRESTOPPING
- 07 8446 FIRE-RESISTIVE JOINT SYSTEMS
- 07 9200 JOINT SEALANTS

DIVISION 08 – OPENINGS

- 08 1213 HOLLOW METAL FRAMES
- 08 1416 FLUSH WOOD DOORS
- 08 4413 ALUMINUM CURTAIN WALL
- 08 5113 ALUMINUM WINDOWS
- 08 7100 DOOR HARDWARE
- 08 8000 GLAZING
- 08 8110 FIRE-RATED GLASS

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SECTION 00 11000 – SUMMARY OF WORK

00 11000

DIVISION 09 – FINISHES

09 2216	NON-STRUCTURAL METAL FRAMING
09 2613	GYPSUM VENEER PLASTERING
09 2900	GYPSUM BOARD
09 5113	ACOUSTICAL PANEL CEILINGS
09 6513	RESILIENT BASE AND ACCESSORIES
09 6519	RESILIENT TILE FLOORING
09 9123	INTERIOR PAINTING

DIVISION 22 – PLUMBING (for roof drain work)

22 0517	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
22 0529	HANGERS AND SUPPORTS FOR PLUMBING PIPING
22 0719	PLUMBING PIPING INSULATION
22 1413	FACILITY STORM DRAINAGE PIPING
22 1423	STORM DRAINAGE PIPING SPECIALTIES

B. Special Notes: Contract #1 - General Work Contractor:

1. General Work Contractor to carry Ossining CSD insurance coverages as outlined in Section 007250 – Insurance requirements – Contractor, located in the specification.
2. Work hours M-F 7:00am- 4:30pm. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
3. All abatement work is by Contract # 1- General Contractor
4. Access doors furnished by trade requiring access; installation by Contract #1 - General Contractor.
5. All new roof rails and pipe portals to be supplied, assembled and placed on roof by MC. GC will install wood blocking, install rails/portals, provide structural steel supports, cut opening, patch roofing, flash in curb and provide temporary watertight/plywood secure of opening until rooftop HVAC unit is set.
6. GC is specifically reminded that there may be miscellaneous asbestos pipe insulation/fittings above some ceiling and inside wall areas. Contractor will investigate above the ceiling and walls prior to demolition and carefully perform the removal where necessary to not disturb any insulation/fittings.
7. All roof drain, piping and related demolition and new work shown on drawing P203 is by GC's roofing subcontractor.
8. GC will install metal studs, plywood sheathing, plastic, for weather tight and secure assembly at window and door areas, until permanent windows and doors are installed.
9. GC is notified that schedule will require multiple mobilizations and multiple crews of certain subcontractors (steel, roofing, etc.).
10. All temporary partitions as outlined in 015000 and shown on staging plans are by GC.
11. GC will paint all existing frames scheduled for new doors/hardware on door schedule. Frame to be painted on all sides.
12. General Contractor is specifically notified that access to any tunnel crawl space areas is confined work environment and all workers must have appropriate OSHA certifications and training.
13. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction.

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SECTION 00 11000 – SUMMARY OF WORK

00 11000

This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

1.5 CONTRACT #2 – MECHANICAL CONTRACTOR (HVAC OR MC)

- A. In addition to the General Requirements, Divisions 0 & 1, included in this bid package contractor shall provide for proper completion of the work as indicated on all drawings and in accordance with the terms and conditions described in the following specifications :

DIVISION 02 - EXISTING CONDITIONS

02 4119 SELECTIVE REMOVAL
02 8300 LEAD SAFE WORK PRACTICES

DIVISION 05 – METALS

05 5000 METAL FABRICATIONS (HVAC -related supports)

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 8413 PENETRATION FIRESTOPPING
07 9200 JOINT SEALANTS

DIVISION 23 – HEATING VENTILATING & AIR CONDITIONING

23 0001 GENERAL PROVISIONS FOR MECHANICAL WORK
23 0002 MECHANICAL AND ELECTRICAL COORDINATION
23 0513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 0517 SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
23 0518 ESCUTCHEONS FOR HVAC PIPING
23 0523 GENERAL-DUTY VALVES FOR HVAC PIPING
23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 0713 DUCT INSULATION
23 0719 HVAC PIPING INSULATION
23 0900 INSTRUMENTATION AND CONTROL FOR HVAC
23 0993 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
23 2213 STEAM AND CONDENSATE HEATING PIPING
23 2216 STEAM AND CONDENSATE PIPING SPECIALTIES
23 3113 METAL DUCTS
23 3300 AIR DUCT ACCESSORIES
23 3600 AIR TERMINAL UNITS
23 3713 DIFFUSERS, REGISTERS, AND GRILLES

DIVISION 26 – ELECTRICAL

26 0519 LOW-VOLTAGE CONDUCTORS AND CABLES (for HVAC control wiring)

- B. Special Notes: Contract #2 – HVAC (Mechanical) Contractor:
1. HVAC Contractor to carry Ossining CSD insurance coverages as outlined in Section 007250 – Insurance requirements – Contractor, located in the specification.
 2. Work hours M-F 7:00am-4:30pm. Contractor will appropriately man the project to

avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.

3. Access doors are furnished by HVAC Contract #2 and installed by GC Contract#1.
4. HVAC to reinsulate piping to remain on 1st & 2nd floors which is abated as indicated on drawings H103 , H 201 , AA100 & AA101.
5. Any existing ceiling removal/replacements necessary to install new HVAC work will be by HVAC Contractor Contract #2. Includes temporary supports for light fixtures, smoke detectors, etc.
6. All new roof rails and pipe portals to be supplied, assembled and placed on roof by MC. GC will install wood blocking, install rails/portals, provide structural steel supports, cut opening, patch roofing, flash in curb and provide temporary watertight/plywood secure of opening until rooftop HVAC unit is set
7. Removal of any existing roof mounted HVAC items is by Contract #2.
8. HVAC Contractor Contract #2 is responsible for making their own through wall and through floor duct and piping penetrations and associated patching/firestopping.
9. Disconnects, starters, etc. supplied by HVAC installed by EC, unless noted otherwise.
10. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

1.6 CONTRACT #3 – ELECTRICAL CONTRACTOR (EC)

- A. In addition to the General Requirements, Divisions 0 & 1, included in this bid package contractor shall provide for proper completion of the work as indicated on all drawings and in accordance with the terms and conditions described in the following Specification Sections.

DIVISION 02 - EXISTING CONDITIONS

- 02 4119 SELECTIVE REMOVAL
02 8300 LEAD SAFE WORK PRACTICES

DIVISION 05 – METALS

- 05 5000 METAL FABRICATIONS (Electrical-related supports)

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

- 07 8413 PENETRATION FIRESTOPPING

DIVISION 26 – ELECTRICAL

- 26 0010 SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL
26 0519 LOW-VOLTAGE CONDUCTORS AND CABLES
26 0526 GROUNDING AND BONDING
26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 0544 SLEEVES & SEALS FOR ELECTRICAL RACEWAYS & CABLING
26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 0923 NETWORK LIGHTING CONTROLS

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26 2726 WIRING DEVICES
26 5100 INTERIOR LIGHTING

DIVISION 27 – COMMUNICATIONS

27 0000 COMMUNICATIONS INSTALLATION OVERVIEW
27 5117 MODIFICATIONS TO EXISTING PUBLIC ADDRESS SYSTEM

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 0153 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY
28 3111 FIRE ALARM SYSTEM

B. Special Notes: Contract # 3 – Electrical Contractor:

1. Electrical Contractor to carry Ossining CSD insurance coverages as outlined in the Section 007250 – Insurance requirements – Contractor, located in the specification.
2. Work hours M-F 7:00am-4:30pm. Contractor will appropriately man the project to avoid Saturday and Overtime hours which result in Owner, Construction Manager and Architect additional costs.
3. Access doors are furnished by Electrical Contract #3 and installed by GC Contract #1.
4. EC is specifically notified that access tunnels / crawl spaces are confined work environments all workers must have appropriate OSHA certification & training.
5. Any existing ceiling removal/replacement necessary to install new electrical work to be by Electric Contract #3.
6. Above the second floor corridor ceiling there are two +/- 3' x 3' electric pull boxes which will need to be lowered and temporarily supported from floor and anchors cut free from the deck, in order to permit the GC installation of the FRP reinforcing strips to the underside of the concrete deck. Reinstall after GC work completed as directed.
7. VFD's, disconnects, motor starters which are supplied by MC will be installed by EC, unless noted otherwise.
8. Contractor is specifically reminded about their responsibilities for clean-up as per section 017423. In addition to daily cleaning, the contractor is required to hire a professional cleaning company to final clean all areas impacted by the construction. This includes completely cleaning any surfaces/equipment/furniture which has been dusted by the construction work. If the contractor does not properly perform this function when directed by the Owner/CM, the owner will perform the work with others and deduct the cost from the contractor.

1.7 PRIME CONTRACTOR'S USE OF PREMISES

- A. Use of the Site:** Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
1. Owner Occupancy: Allow for Owner occupancy, work by other Owner contractors and use by the public.
 2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment onsite.

3. Delivery black out times - No Contractor trucks/deliveries are allowed during school bus times as indicated by owner approx. : 7:00am-8:30am or 2:00pm-3:30pm.
4. Existing building spaces may not be used for storage unless approved by the Owner.
5. Time Restrictions: Working hours M-F 7:00am-4:30pm.
6. Owner's representative(s) will cover the project for the standard 8-hour Monday-Friday shift. If contractor requests additional hours to make up schedule time or weekends, he will need to reimburse Owner for any additional coverage or costs (e.g. Architect, Construction Manager, Custodian and Security) at their contractual rate.
7. No contractor work will be allowed during testing/ELA/regent's time periods. No additional costs to Owner for not working during these testing times (figure 5 days)
8. Contractors shall comply with Local Noise Ordinance. Work disrupting the community must be performed within the following hours:
 - a. Monday thru Friday: 8am to 8pm.
 - b. Weekends/Holidays: 9am to 6pm.
9. General: Limitations onsite usage as well as specific requirements that impact utilization are indicated on the drawings and by other contract documents. The Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment onsite.
10. Only materials and equipment, which are to be used directly in the work, shall be brought to and stored on the project site by the Contractor. After equipment is no longer required for the work, it shall be promptly removed from the project site. Protection of construction materials and equipment stored at the project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.
11. Confine stock piling of materials and location of storage sheds to the areas indicated. If additional storage is necessary obtain and pay for such storage off-site.
12. The Contractor(s) and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.
13. Contractor shall ensure that the work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the work shall be free from all debris, building materials and equipment likely to cause hazardous conditions.
14. Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitations, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with the rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project Site, and the Building, as amended from time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations. The Contractor shall also comply with all insurance requirements, applicable to use, and occupancy of the Project Site and the Building.
15. **Maintain the existing building in a safe and weather tight condition throughout**

the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. When work is scheduled after hours clean and remove all temporary barriers and protection so that the building can be occupied the following day when normal building occupancy will occur.

16. Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris.
17. Utility Outages and Shutdown:
 - a. Limit disruption of utility services to hours the building is unoccupied, weekends or holidays at no additional cost.
 - b. Do not disrupt or shutdown life safety systems, including but not limited to fire alarm system. Provide 7 days' notice to Ossining Union Free School District and authorities having jurisdiction.
 - c. Prevent accidental disruption of utility services to other facilities.
 - d. All costs for manning of temporary shutdowns and utility crossovers, including 24-hour fire watch as necessary to maintain the life safety systems, is included in the contractor's bid regardless of weekend, holiday, etc.

1.8 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations.
- B. Partial Owner Occupancy: The Owner reserves the right to occupy the place and install equipment in completed areas of the work prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work, such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
 1. The Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner occupancy.
 2. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions of the building.
 3. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions of the building.

1.9 PRODUCTS ORDERED IN ADVANCE

- A. None

1.10 DEFINITIONS

- A. Definitions as applied to "Contractors" involved with the work of this Project:
 1. "The Contractor" or "Contractor" meaning that Respective Prime Contractor normally responsible for that work referenced;
 2. "Respective Prime Contractor" meaning either the-General Contractor, Plumbing, HVAC or Electrical Contractors normally responsible for the referenced work;

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3. “Trade Contractor” meaning that Respective Prime Contractor as above; and such other terms relating to Contractors to be taken in context with respect to referenced work.
 4. Further, wherein said Division 0 and 1 and respective Sections there in, any reference is made to “General Contractor”, same shall be construed to mean “Contractor for the General Construction, or General Work Contractor”.
 5. The Architect cannot guarantee the correctness of the existing conditions shown and assumes no responsibility therefore, it shall be the responsibility of the Contractor to visit the site and verify all existing conditions prior to bid.
- B. The Owner will purchase certain items required for the overall operation of this facility.
1. The Contractor(s) will cooperate with said vendors as maybe necessary to permit the work to be accomplished.
 - a. The cooperation may extend to the receiving, unloading and placement of said equipment if directed by the Owner.
 - b. Terms of payment, if any, shall be in accordance with the General Conditions as amended or modified.
- C. Each Contractor is advised that the Owner may enter into separate contracts as may be in their best interests.
- D. Each Contractor is further advised that there will be a full-time on-site Project Representative/Construction Manager, whose duties will be defined at the pre-construction meeting.
- E. ADDITIONAL SECURITY PROVISIONS
1. All Contractors’ employees shall use a single means of access and egress, except in the case of emergency, to be designated by the Construction Manager.
 2. Each Contractor and each Subcontractor shall require his employees, while on the jobsite, to wear, in a conspicuous location, a Photo I.D. badge bearing the name of the employee and the Contractor. The buttons of each Contractor shall be numbered consecutively. An up-to-date list of all I.D. badges, indicating the name and number for each employee, shall be furnished to the Construction Manager.

1.11 ASBESTOS AND LEAD PAINT AWARENESS REQUIREMENTS

- A. Contractor agrees not to use or permit the use of any asbestos containing material in or on any property belonging to the Owner.
- B. For purposes of this requirement, asbestos free shall mean free from all forms of asbestos, including - actinolite, amosite, anthrophyllite, chrysotile, cricidolite and tremolite, both infriable and non-friable states and without regard to the purposes for which such material is used.
- C. Reference Abatement Sections of these documents for procedures and protocols to be followed in the event of discovery of any suspect asbestos, lead or hazardous materials.
- D. Contractors will investigate/verify then carefully demolish existing ceiling and/or wall items so as not to disturb any asbestos containing fittings and/or insulation which may be located above existing ceilings or inside walls.

1.12 CONSTRUCTION TIME AND PHASING REQUIREMENTS

- A. Each Contractor is advised the “time is of the essence” of the Contract as defined in the “General Conditions” for the completion of the construction of the facility.
 - 1. It is understood that the work is to be carried through to completion with the utmost speed consistent with good workmanship.
 - 2. Time of Completion shall be as established in the Milestone Schedule (Section 01 11 00).
 - 3. Further, safe and legal ingress and egress shall be maintained at all times to and through the occupied portions of the construction site.
- B. Work shall proceed in such a manner as to cause the least amount of disruption to the Owner’s ongoing operations as possible.
- C. Coordinate closely with school operating personnel.
- D. All work and storage areas shall be completely enclosed by a fence or barricade at all times so that no student or the public can approach the area or the equipment.
 - 1. The Contractor shall maintain fences and barricades at all times and shall-
 - 2. Repair/restore and/or pay for any temporary fencing damaged by their work.
 - 3. Maintain at all times, all exits and walkways.
 - 4. Where the barricade is removed for work, the Contractor performing such work shall provide adequate safety personnel to prevent unauthorized persons from approaching the work area.
- E. Construction Phasing
 - 1. The phasing and/or milestone schedule contained in Section 01 11 00 has been established for the overall construction of the project.
 - 2. Each Contractor is advised that areas of the existing buildings which are to be added to and/or altered under this Contract will remain in use during construction, coordinate with Section 01 50 00 for Temporary Facilities.
 - 3. Electrical and mechanical services to the functioning spaces shall be maintained at all times.
 - 4. Swing-over stone facilities shall be made so as to cause the least interruption to the facilities’ operations.
 - 5. Limit utility shut downs to three non-school work days at no additional cost to the Owner unless prior agreement is made with the operating personnel of the facility.
 - 6. The Contractor shall provide and maintain all required separations between old and new construction to prevent: Unauthorized entrance to construction areas by others than Architect, Construction Manager or Owner, heat loss from existing building, water (rain or ground) infiltration in to existing building.
 - 7. Exterior alteration and restoration, as required, may proceed outside of phasing schedule at the Contractor’s option with concurrence from the Architect, Construction Manager and Owner.
 - 8. Site development work shall proceed in such a manner to cause the least amount of disruption to the ongoing operations as possible.

1.13 PROOF OF ORDERS AND DELIVERY DATES, AND SUPPLY CHAIN TRACKING–
(COORDINATE WITH SECTIONS 01 33 00 AND 01 32 16.)

Within 2 weeks after the approval of shop drawings, samples, product data and the like, the Contractor shall provide copies of purchase orders for all equipment and materials which are not available in local stock. The Contractor shall submit written statements from suppliers confirming the orders and stating promised delivery dates. Failure to provide this critical information will result in holding monthly requisition payments until received.

Due to COVID-19 and it's potential to disrupt material supply-chains, the contractors are required to obtain all materials for the project and store them onsite in their individual Conex boxes as soon as they are available but no later than May 30, 2022.. This includes general material items typically readily available (piping, conduits, wire, metal studs, ceiling, etc.). The owner will pay for these stored items delivered to the jobsite in accordance with Section 012900.

This information shall be incorporated within the progress schedules so required as part of Section 01 32 16 and 01 33 00 and shall be monitored so as to ensure compliance with promised dates.

1.14 INTENT OF DOCUMENTS

- A. In the event of conflict, ambiguity and/or unclear circumstances between any of the requirements of the Contract Documents, the requirement that is most inclusive and of highest quality, quantity, and/or cost shall govern. The Contractor shall (1) provide the better quality or greater quantity of Work and/or (2) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation. The Contractor herewith agrees that no extra compensation shall be awarded to him based upon a claim of conflict, ambiguity or unclear circumstances in the Contract Documents. See the General Conditions for greater detail.

1.15 FIELD MEASUREMENTS

- A. Each Respective Prime Contractor shall take all necessary field measurements prior to fabrication and installation of work and shall assume complete responsibility for accuracy of same.
- B. This project is an ALTERATION AND ADDITION and therefore necessitates additional attention to existing conditions receiving newly fabricated and installed equipment, i.e. note the requirements for field dimensioning of shop fabricated items whether or not so required by each technical section.

1.16 INITIAL SUBMITTAL REQUIREMENTS

- A. As outlined in Division 01, each Contractor shall provide items noted including - bonds, insurance, emergency telephone numbers, progress scheduling, schedules of submittals,

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subcontractor listings and the like prior to the start of any work. The Owner will not issue contracts until all bond and insurance information is received by the contractor and verified correct.

1.17 SCHEDULES

- A. The milestone schedule presented in the documents is for bidding and general purposes. Due to the nature of the work, it is the intention of the Construction Manager to negotiate actual work periods for the project among the various Prime Contractors involved with this bidding process, as well as separate contractors involved with other phases of the work solicited under separate proposals. Each Contractor shall, under terms of Article 6 of the General Conditions, mutually cooperate in the rescheduling of work to permit an uninterrupted use of the facilities by the Owner, without additional cost to the Owner.
- B. General
 - 1. The objective of this project is to complete the overall work in the shortest period of time and to protect the building and occupants from damages caused by weather and construction activity during the progress of the work.
 - 2. To meet these objectives, the Contractor shall plan the work, obtain materials, and execute the construction in the most expeditious manner possible in accordance with the requirements listed below.
 - 3. If the Contractor fails to expedite and pursue any part of the work, the Owner may terminate the contract as per Article 14.2 or may carry out the work as per Article 2.4 of the General Conditions.
 - 4. The Contractor shall work in coordination with work of other Contractors and with school activities with special attention to prevent noise, dust and other contract requirements for work in and around the occupied buildings.
 - 5. All contractors are required to comply with proper sequencing of work and provide other prime contractors sufficient time to install their work (e.g.-metal stud walls get fully framed; MEP contractors perform roughing/testing/inspections; then walls are sheathed with gypsum - no sheet rocking one side unless Construction Manager approved). If Contractor “boxes out” another Prime Contractor, he will be directed to stop work and open if necessary, to enable other trades to complete their work. No compensation for lost time due to stop - work will be provided.
- C. Milestone Schedule (See Section 01 11 00).

1.18 ADDITIONAL REQUIREMENTS

- A. The following are additional general and special requirements which will govern the work of the projects covered by these Documents.
 - 1. If it appears that some of the work cannot be completed by the scheduled date, the Contractor shall increase the work force or increase the hours of work, including evenings and weekends as necessary, and cover any additional costs to the Owner, Architect and Construction Manager.
 - 2. If the work is complete but the area is not cleaned and debris or equipment is not removed, the Owner shall have the right to prepare the area for occupancy with his own forces and deduct the costs from the Contract Amount. (If Contractor does not respond within 4 hours’ notice).
 - 3. If the Contractor fails to staff the job adequately to meet the completion date, the

Owner reserves the right to assume possession of the material and complete installation with the Owner's forces or other Contractors or to require the Contractor to work evenings and weekends. Any additional coverage costs for Owner and Construction Manager will be charged to contractor.

4. The school can sometimes be made available on weekends and evenings to allow the Contractor adequate time to complete the work before final completion date. Any custodial, Architect, or Construction Manager costs resulting in this after-hours scheduling will be the Contractor's responsibility at their contractual hourly rate.
5. In addition to the above - stated requirements for phasing of the work, the Contractors shall not do any noisy work in the areas where examinations will be conducted as per the published school calendar.
6. Work in each work period shall progress at least at a pace in proportion to the Contract time available.
7. The Contractor is responsible for temporary protection of all work until acceptance.
8. The school will be closed on Saturdays, Sundays, regularly schedules district holidays, and at night after cleaning crews have finished.
9. All existing conditions must be verified in the field. The Owner takes no responsibility for actual conditions found deviating from the drawings. If existing condition interferes with contract work, contractor is responsible to eliminate this condition.
10. Contractor must plan, provide and maintain his own access, ramping, and egress as required into and out of the site, staging of trailer(s), materials, machinery, and equipment in agreement with the Construction Manager's Superintendent. Maintain free and safe access on the jobsite for other related project personnel. Maintain safe pedestrian or vehicular traffic must be regulated by a flagman. Trucking and delivery operation should be coordinated with Construction Manager's Superintendent and all other trades.
11. Contractor is responsible for all work shown on Contract Documents, including drawings of other trade disciplines. For example, the HVAC Contractor will be responsible for HVAC work shown on Architectural Drawings.
12. Contractor is responsible to maintain existing site fencing in its existing condition. Modifications to the fence to better accommodate the contract work can be discussed with the Construction Manager. These changes shall then be handled by this contractor at his expense and in accordance with the Construction Manager's Superintendent's direction. Any cost incurred as a result of damages shall be charged to this contractor.
13. Contractor's personnel will not be permitted to use Ossining Union free School District's facilities (including toilet, telephone, food services, etc.) for their own benefit. Contractors' Superintendent must explain this to all their field forces.
14. Time is of the essence. Contractors' proposed schedule must be approved by the Construction Manager. Contractor shall indicate significant events such as submittals, shop drawings, material ordering, fabrication, delivery, coordination precedents, installation, testing and turnover by area or system as agreed with Construction Manager. A revised progress status shall be required on a weekly basis.
15. Decisions required from the Construction Manager, Architect and/or Engineer, shall be anticipated by the Contractor to provide ample time for inspection, investigation or detailed drawings.
16. Contractor shall limit his operations including storage of materials and prefabrication to areas within the Contract Limit Lines unless otherwise permitted by the Construction Manager at the Owner's option.
17. Contractor shall coordinate the use of premises with the Owner and Construction Manager and shall move at his own expense any stored products under Contractor's

control, including excavated material, which interfere with operations of the Owner or separate contractors.

18. Contractor shall obtain and pay for the use of additional storage of work areas needed for operations.
19. Contractor shall assume full responsibility for the protection and safe keeping of products under this Contract stored on the site and shall cooperate with the Construction Manager to ensure security for the Owner's Property.
20. The intention of the work is to follow a logical sequence; however, the Contractor may be required by Construction Manager to temporarily omit or leave out any section of his work or perform his work out of sequence. All such out of sequence work and come back time to these areas shall be performed at no additional cost.
21. Contractor shall submit a three - week schedule (man-loaded by work activity and area) to Construction Manager each week. Contractor's representative shall attend a weekly meeting with all contractors, chaired by Construction Manager, for the purpose of job coordination and sequencing. Contractor is responsible to coordinate the job with other trades and Construction Manager, and to cooperate with other trades in pursuit of the overall project's shop drawings and actively participate in resolving discrepancies, conflicts, interferences, etc.
22. Each Prime Contractor shall prepare an overall job schedule for his portion of work upon award of Contract, as per Section: Construction Progress Schedule.
23. Sufficient man power shall be provided at all times to maintain progress of the job. A shortage of labor in the industry shall not be accepted as an excuse for not properly manning the job.
24. The contractor shall take special care in verifying that his equipment matches the characteristics of the power being supplied.
25. Any contractor personnel including project managers, supervisors, etc. who engage in any personal attacks, belligerent or threatening speech/texts, etc., to the Owner, or any of its agents, will be removed from working on the project.
26. Insubordination, unsafe practices, horseplay, abusive behavior or language, wanton destruction of property, use of drugs or alcohol, possession of firearms, and solicitation shall not be tolerated. There will be no warnings, and Contractor shall designate a responsible on-site supervisor to handle any situations that may arise, including termination.
27. Each contractor is responsible to supply and install all wood blocking/bracing necessary to properly secure their work. This responsibility includes coordinating the installation in concealed areas without delaying other trades.
28. Union business shall not be conducted onsite. Any Union representatives that visit the site must declare what Contractor's personnel they represent, and must be escorted by that Contractor's Union steward at all times. No visitors, sales representative or non-working personnel shall be permitted onsite without prior consent of the Construction Manager. No photographs shall be taken without the Construction Manager's prior approval.
29. Organize daily cleanups as well as participating in a weekly joint cleanup involving all prime contractors onsite. Cleanup shall be considered a safety issue. If any contractor fails to keep the site safe and brook clean within 4 hours of being notified by the Construction Manager, either verbally or in writing, the Construction Manager will have the cleanup work performed by others and will back charge accordingly.
30. Contractor shall provide protection from damage to adjacent and adjoining work and/or structures. Contractor shall clean, repair and/or replace any damage for which this contractor is responsible.

31. Contractor shall examine surfaces and conditions prior to start of work. Report unacceptable conditions to the Construction Manager. Do not proceed until unacceptable conditions are corrected and acceptable. Starting of work implies acceptance.
32. Upon removal of exterior walls and window units, the building security and weather protection is the responsibility of the prime contractor performing the removals.
33. Each Prime Contractor shall include general housekeeping of light debris. All debris from each Prime Contractor will be collected daily and disposed of into their own dumpsters. **In addition to daily general housekeeping, the General Contractor (Contract #1) shall provide a daily broom sweep and weekly damp mop of all areas for the entire duration of the project.** The broom sweep and damp mop shall include debris from all trades working onsite.
34. SLEEVES AND SLEEVE LAYOUT - It is the responsibility of the Prime Contractor requiring a sleeve to provide the sleeve and a layout sketch to the Prime Contractor performing the construction activity that the sleeve goes in.
35. Each contractor is responsible to review and become familiar with the scope of work included in all Contracts.
36. Limited site space is available in areas as designated by the Construction Manager. Construction trade parking is not permitted in Owner's employee parking lot.
37. Each contractor shall provide the engineering layout required to properly complete his work from an established working point. Contractor shall employ only competent engineering personnel skilled in performing layout tasks of similar complexity.
38. Prior to commencing the work, each Contractor shall provide written acceptance of grades, structures, substrates, and/or systems installed by other Contractors as suitable for installation of his work. Failure to provide this verification prior to commencing work shall constitute acceptance of the existing conditions.
39. Each Contractor shall coordinate with the Construction Manager for lay down areas, staging areas, and overall use of project site.
40. All contractors and their employees, subcontractors and supplier are expressly prohibited from entering the occupied areas of the school buildings during school hours without prior written permission of the Construction Manager and for using any of its facilities (i.e. restrooms, cafeteria, etc.).
41. Each contractor is responsible for the timely provision of the information required by other Contractors for the progress of other Contractors' work.
42. All contractor foreman must have working cell phone and number provided to Construction Manager.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION (NOT USED)**

END OF SECTION

SECTION 01 11 00 - MILESTONE SCHEDULE**PART 1 - GENERAL****1.1 MILESTONE**

The following milestone schedule serves as a basis for bidding. A Master Schedule will be developed at a general meeting with the low bidders within 21 days of Letter of Intent to Award the Contracts. Each prime contractor will coordinate activities, forward submittals, deliver materials and provide necessary manpower to meet the milestones listed below.

1.2 MILESTONE SCHEDULE

Ossining High School – 3rd Floor Connector	Start	Finish
• Asbestos Abatement (includes final air clearances and temporary critical barriers) Multiple Crews, double shift as necessary, for full air clearance by 7/3/22	6/24/22	7/2/22
• Staging & Protections	6/24/22	6/28/22
• 1 st & 2 nd floor work (must be completed for start of school)	6/27/22	8/19/22
• 3 rd floor Connector – steel with decking & watertight roof	----	8/12/22
• Scaffolding for 3 floor corridor complete		8/12/22
• All remaining work	----	10/07/22

Contractors are specifically notified that they may need to work multiple crews simultaneously in order to meet the production rates and complete the work (M-F work week) by the above completion dates.

Any additional work/coverage costs required by the owner's representatives including Construction Manager, Architect and custodians due to schedule overage beyond the milestone dates, if determined to be caused by the contractor, will result in a deduct change order at the owners/representative's contractual rate.

The objective of this project is to complete the overall work in the shortest period of time. Thus, if access is provided to a work area sooner than originally scheduled, each contractor will likewise mobilize their forces earlier to maintain the reduction in overall schedule time. Each Contractor is advised that "Time is of the essence" as per the General Conditions of the contract and they will work with multiple crews of sufficient size as necessary to carry out the work with the utmost speed with good workmanship. If the contractor fails to expedite and pursue any part of the work, the Owner may order the contractor to take "Extraordinary Measures", or hire others to complete the work and adjust their contract amount accordingly as per the General Conditions.

The abatement schedule for the existing renovation areas is critical to all prime contractors meeting their installation schedule. The GC will have multiple abatement crews working simultaneously in all areas to ensure final air clearance by the dates indicated.

Contractors are specifically notified that they must properly man the project with a competent field superintendent and a sufficient supply of tradesmen to maintain progress and flow of work as required by schedule and to coordinate/install timely for other trades.

All trades are specifically notified that construction is phased which necessitates that utilities/services will need to be temporarily disconnected/connected and maintained as necessary to ensure that all occupied areas have the required services without interruption (mechanical, electrical, fire alarm, PA, etc.).

All work required by any of the Owner's representatives and consultants, including the Construction Manager, Architect, Architect's consultants, Owner's Attorneys, etc., to execute final the contract beyond Milestone dates, or to executed final closeout after 30 days past substantial completion, if determined to be caused by contractor, shall result in payment(s) to the Owner for additional services to the Construction Manger, Architect, Architect's consultants, Owner's Attorneys, etc. These costs will then be issued in the form of a deduct change order to the contractor's contract at the Owners consultants' contractual rate.

PRODUCTS (Not Applicable)

EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 21 00 – ALLOWANCES

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 governing allowances.
- B. Types of allowances include the following:
 - 1. Contingency allowances.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section " Contract Modification Procedures" specifies procedures for submitting and handling Change Orders.

1.3 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.4 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed for the Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. **The Contractor's overhead and profit, including costs for bonds and insurance, delivery, equipment rental and similar costs, for these allowances shall be included in the values of the general requirements of the base bid contract sum and are not chargeable under allowance disbursement.**
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to the Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. CONTRACT 1- General Work Contractor:

1. Allowance GC-1, General Allowance: **CONTRACT 1** shall include a contingency allowance totaling **\$ 50,000** for use according to the Owner's instructions:
2. Allowance GC-2: VAT Floor Tile / Mastic Allowance - the Contractor shall include in their base bid an allowance of 20 SF asbestos containing floor tile/mastic if encountered
3. Allowance GC-3: Asbestos Insulation / fitting Allowance - the Contractor shall include in their base bid an allowance of 20 LF asbestos insulation and/or fittings removal and if encountered.
4. Allowance GC-4: Asbestos Caulking Allowance - the Contractor shall include in their base bid an allowance of 50 LF of removal of asbestos caulking if encountered.

B. CONTRACT 2- Mechanical Work Contractor:

1. Allowance MC-1, General Allowance: **CONTRACT 2** shall include a contingency allowance totaling **\$ 25,000** for use according to the Owner's instructions:

C. CONTRACT 3- Electrical Work Contractor:

1. Allowance EC-1, General Allowance: **CONTRACT 3** shall include a contingency allowance totaling **\$20,000** for use according to the Owner's instructions:

END OF SECTION 01 21 00

SECTION 01 22 00 – UNIT PRICES

PART 1 - GENERAL

DESCRIPTION

- A. This Section specifies the requirements for measurements and records made for payment purposes and describes the item(s) under which payment(s) will be made for the Work performed under this Contract.
- B. All work shown or specified in the Contract Documents shall be performed.
- C. Items not specified to be measured or paid for (for which no specific pay item exists in the Price Schedule) shall be included in an appropriate unit price item or in a lump-sum item.

MEASUREMENT REQUIREMENTS

- D. All required measurements shall be made by the Contractor with the Engineer.
- E. Any measurements not witnessed by Engineer and which cannot be verified or substantiated by Engineer will not be approved and payment under the item(s) requiring such measurements will not be made.
- F. Coordinate measurements monthly, for the preparation of periodic pay estimates.
- G. Where payments will be made for removing rock and existing materials, notify Engineer so that he may witness the measurements.
 - 1. All materials removed without conforming to the above procedures, which Engineer cannot verify or substantiate, will not be paid for.
 - 2. Maintain complete, neat, clean, and legible field notes for all measured items.
 - 3. Notes shall contain spaces for Contractor's and Engineer's signatures plus additional space for comments.
 - 4. An original and a carbon copy shall be made for all notes and one copy shall be turned over to Engineer daily.
 - 5. The Engineer's signature shall not be constituted as an acceptance of the work, or the measurements made, but shall mean that he was present when the measurements were made.

SUBMITTALS

- A. See Section 013300.
- B. See Section 012300.
- C. Field notes of all measurements for payment purposes delivered to Engineer daily.

- D. Copies of all invoices required for payments out of cash allowance(s).
- E. Monthly Applications for Payment.
- F. Record Drawings showing the locations and quantities of all items measured for payment purposes.

SCHEDULING

- A. Notify Engineer, as far in advance as possible, of the recording of measurements so that Engineer may observe existing conditions, work being performed, and measurements being made.
- B. Allow for and afford Engineer ample time, space, and equipment to observe measurements and to verify measurements and elevations.

PART 2 - PRODUCTS

GENERAL

- A. Provide all labor, materials, facilities, levels, measuring devices and all other equipment and items necessary to properly and accurately perform all measurements for payment purposes.
- B. Payment for certain items not specifically listed in the bid forms but otherwise required by the technical specifications shall be deemed included as part of the General Conditions and the individual unit price and lump sum bid items provided for in the proposal.

PART 3 – EXECUTION

GENERAL

- A. Perform all measuring required under this Section.
- B. Record all measurements and calculated quantities on the Record Drawings.
- C. No measurement shall be made for work performed within the limits of Lump Sum Items.

PART 3.1 - UNIT PRICE SCHEDULE

General Contractor

- A. Unit Price GC No. 1: Abatement of ACM Floor Tile (VAT) with a field fabricated tent enclosure as per code rule 56
 - a. Description : abatement of ACM Floor Tile & mastic (VAT) to be used as an add or deduct from base bid quantities
 - b. Unit of Measurement : per square foot (SF) of VAT / Mastic

- B. Unit Price GC No. 2: Abatement of ACM Fittings/Insulation within a containment area
 - a. Description : Supply & install all material and labor for abatement of ACM fittings or insulation to be used as an add or deduct from base bid quantities
 - b. Unit of Measurement : per linear foot of elbow or insulation
- C. Unit Price GC No. 3: Abatement of ACM Fittings/Insulation with a field fabricated tent enclosure as per code rule 56 (Figure up to 10 fittings per tent)
 - a. Description : Supply & install all material and labor for abatement of ACM fittings or insulation to be used as an add or deduct from base bid quantities
 - b. Unit of Measurement : per linear foot of elbow or insulation
- D. Unit Price GC No. 4: Abatement of ACM Caulking
 - a. Description : abatement of ACM caulking to be used as an add or deduct from base bid quantities
 - b. Unit of Measurement : per linear foot of caulk

END OF SECTION

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Documents 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 the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the Alternate into the 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 the 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. List of Alternates: Alternates, if any, are included on the Form of Proposal.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2300

SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue 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."

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect 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 are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation for 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 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.
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 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.
 5. 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: The form included in Specification Section entitled "PROJECT FORMS AND RELATED DOCUMENTS" shall be used for Proposal Requests.

- D. All contractor proposals, regardless of who initiates, will be accompanied by a detailed material and labor breakdown, substantiating invoices/quotes and a notarized labor rate breakdown sheet, see attached to back of this section.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. A Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. A Construction Change Directive shall contain a complete description of change in the Work. It shall also designate methods 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 01 2600



Arris Contracting Company, Inc.
189 Smith Street
Poughkeepsie, NY 12601

LABOR RATE WORKSHEET

Project No. _____

Contractor Name: _____	County: _____	Date: _____
Address: _____		
Telephone Number: _____		

Trade: _____ (Provide separate sheet for each trade, foreman/journeyman, etc.)	REGULAR BASE RATE	PREMIUM TIME BASE RATE

A. WAGE RATE PER HOUR

BENEFITS (* Identifies benefits paid directly to the Employee.)	*	% per hour	\$ per hour	
Vacation and Holiday				
Health and Welfare				
Pension				
Annuity				
Education / Apprentice Training				
Supplemental Unemployment				
Security Fund				
Industry Advancement				
UBC-Appr., Health, Safety, Educ.				
Labor Management Fund				

B. TOTAL BENEFITS PER HOUR

PAYROLL TAXES AND INSURANCE		
F.I.C.A. / Social Security (up to the maximum required by law)		%
Medicare		%
Federal Unemployment (up to a maximum of \$56.00 per employee per year)		%
State Unemployment (up to 1st \$8,500 of base salary paid per employee per year)		%
Workers' Compensation Code: _____		%
Disability		%

C. TOTAL TAXES AND INSURANCE PER HOUR

All Benefits are paid directly to Employee. _____ x _____ % =

Only benefits identified by * are paid directly to Employee.

D. TOTAL LABOR RATE (A + B + C) =

E. DOCUMENTATION

For General Liability and Workers Compensation, provide policy renewal page from insurance carrier (with contractor name, address, and insurance agent) for substantiation purposes.

F. CONTRACTOR'S CERTIFICATION

I certify that the labor rates, insurance enumerations, labor fringe enumerations and expenses are correct and in accordance with actual and true cost incurred.

Signature

Print Name of Authorized Representative

Print Title

Sworn before me this _____ day

of _____, 20____.

Notary Public

SECTION 01 29 00 - PAYMENT PROCEDURES**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 specifies administrative and procedural requirements governing each prime contractor's Applications for Payment.
 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- b. Related Sections: The following Sections contain requirements that relate to this Section.
 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

1.3 SCHEDULE OF VALUES

- a. Coordination: Contractor shall coordinate preparation of its Schedule of Values for the Work with preparation of the Contractors' Construction Schedule.
 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule
 - b. Application for Payment forms, including Continuation Sheets
 - c. List of subcontractors
 - d. Schedule of allowances
 - e. Schedule of alternates
 - f. Schedule of submittals
 2. Submit the Schedule of Values to the Construction Manager within 10 days of receipt of Letter of Intent but no later than 10 days before the date scheduled for submittal of the initial Applications for Payment. (SOV's received after the 15th of the month, will not be allowed to requisition until the following month, due to input time for CM & Owner into their computer systems).
- b. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name, location and SED # **(Each school and additions/renovations, will require separate breakdown sections, front end, etc. with subtotals).**
 - b. Name of the Architect.
 - c. Project number (and SED #).
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

- a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - i. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items where requested by Construction Manager. Multiple line items will be provided for amounts in excess of two percent of the contract sum, broken out into sub components equaling not greater than two percent each. Separate all line items by material & labor.
 - a. Breakdown shall be separated between additions and renovations with subtotals for each.
4. In addition to the breakdown of specification sections, separate line items will be required for the following front-end line items:
 - a. Bonds & OCP insurances to have separate line items. (Substantiation letters required from bonding & insurance company for any amounts higher than industry standard). Only OCP insurance allowed for insurance line item. All other insurance costs must be distributed by contractor throughout the various sections.
 - b. Supervision - include a minimum of one percent of contract sum.
 - c. Project Administration - include a minimum of one percent of contract sum.
 - d. Project meetings (appropriate value for weekly attendance for entire duration of project – figure 20 meetings @ \$ 250.00 per meeting)
 - e. Punchlist - include a minimum of .5 percent of contract sum
 - f. Closeout: separate lines for demobilization, Operation & maintenance manuals, closeout paperwork, demonstration & training (total for closeout minimum two percent of contract value)
 - g. Continuous Clean-up and Final Clean-up values each at minimum of .5%
 - h. General Contractor to add line item for Broom sweep/damp mopping
5. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing.
7. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.
9. Contingency Allowances – list at the end of each breakdown, so that there is room below to list allowances as they are issued. (Contractor's overhead and profit, including costs for bonds & insurances, for these allowances shall be included in the values of the general requirements of contract sum and are not chargeable under allowance disbursement)
10. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, if approved by the construction manager.
11. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- a. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
 - i. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- b. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- c. Payment-Application Times: The date for each progress payment is the 21st day of each month (or as designated by the Owner). The period covered by each Application for Payment is the previous month.
- d. Payment-Application Forms: Use AIA Document G732/CMA (include line for Construction Manager signature) and Continuation Sheets G703 as the form for Applications for Payment.
 - i. Separate Continuation Sheets shall be provided for work which takes place on each building, which will detail that portion of the contract which is attributable to the specific building. The appropriate S.E.D. project number(s) shall be shown on the top of each continuation form.
- e. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Construction Manager will return incomplete applications without action.
 - i. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.

- ii. Include amounts of Change Orders and Allowances issued prior to the last day of the construction period covered by the application. (No Change Order or Allowance requisitions can be made or listed on the requisition, unless the formal CO/AD paperwork has been **fully executed** by Contractor, Construction Manager, Architect and Owner).
- iii. Provide digital copies of payrolls which are signed and notarized documenting compliance with prevailing wage laws. Payroll for contractors is required from the 25th of the previous month to the 24th of the current month. Payroll for subcontractors is required from the 15th of the previous month to the 14th of the current month.
- iv. Provide digital copies of lien waivers for the previous payment (or anticipated payment). Include certificate of monthly payment for subcontractors for the previous month.
- v. Provide OSHA 10 certificates for all workers on site.
- vi. Payment for stored materials (whether onsite but not installed, or offsite in a secured warehouse) will require a bill of lading showing the exact value and photographs. In no case shall more than 90% be approved for uninstalled stored materials. An Insurance certificate must be provided, specific to the materials stored with the appropriate dollar value (for onsite or offsite materials).
- f. Transmittal: Submit digital signed (blue ink) and notarized original copy of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours. Each copy shall be complete, and securely attached to include all waivers of lien, certified payrolls and similar attachments.
 - i. Transmit digitally with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect and Construction Manager.
- g. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors and suppliers for the construction period covered by the previous application.
 - i. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 - ii. When an application shows completion of an item, submit final or full waivers.
 - iii. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - iv. Waivers Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- h. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment include the following. The initial payment application will not be processed until all of these actions and submittals have been received by the Construction Manager. When preliminary submissions are received with the initial application (items 4 and 7), the final submission for these items

must be received and approved by the Construction Manager prior to submission of the second application for payment.

- i. List of subcontractors.
- ii. List of principal suppliers and fabricators.
- iii. Schedule of Values.
- iv. Contractor's Construction Schedule (preliminary if not final).
- v. Schedule of principal products.
- vi. Schedule of unit prices.
- vii. Submittal Schedule (preliminary if not final).
- viii. List of Contractor's staff assignments.
- ix. List of Contractor's principal consultants.
- x. Copies of building permits.
- xi. Copies of authorizations and licenses from governing authorities for performance of the Work.
- xii. Initial progress report.
- xiii. Report of preconstruction meeting.
- xiv. Certificates of insurance and insurance policies.
- xv. Performance and payment bonds.
- xvi. Data needed to acquire the Owner's insurance.
- xvii. Initial settlement survey and damage report, if required.
- i. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
 - i. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 - ii. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Startup performance reports.
 - g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage and consent of surety.
 - j. Advice on shifting insurance coverages.
 - k. Final progress photographs.
 - l. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- j. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
 - i. Completion of Project closeout requirements.
 - ii. Completion of items specified for completion after Substantial Completion.

- iii. Ensure that unsettled claims will be settled.
- iv. Ensure that incomplete Work is not accepted and will be completed without undue delay.
- v. Transmittal of required Project construction records to the Owner.
- vi. Certified property survey.
- vii. Proof that taxes, fees, and similar obligations were paid.
- viii. Removal of temporary facilities and services.
- ix. Removal of surplus materials, rubbish, and similar elements.
- x. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

- 3.1 No retainage release will be approved by owner until all closeout documents (Closeout paperwork, as-builts, O & M manuals, AIA release forms, warranties, material turnover receipts, etc.) are received and verified complete.

END OF SECTION

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Administrative and supervisory personnel.
 - 2. Project meetings.
 - 3. Requests for Interpretation (RFIs).
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
 - 2. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.5 SUBMITTALS

- A. Key Personnel Names: Prior to starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel for the Project. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
 4. Attendance is mandatory at weekly meetings and Contractor will include in their bid a sum of \$250.00 per meeting (figure 20 meetings) to have an authorized individual in attendance capable of making decisions and providing direction. This amount will be listed as a separate line item on the Contractor's Schedule of Values. If the contractor misses a meeting without prior written authorization from the Construction Manager, they will be issued a deduct change order in the amount of \$250.00 per occurrence.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect. Hold the conference at Project site. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Procedures for processing field decisions and Change Orders.
 - e. Procedures for RFIs.
 - f. Procedures for testing and inspecting.
 - g. Procedures for processing Applications for Payment.
 - h. Distribution of the Contract Documents.
 - i. Submittal procedures.
 - j. Preparation of Record Documents.
 - k. Use of the premises and existing building.
 - l. Work restrictions.
 - m. Owner's occupancy requirements.
 - n. Responsibility for temporary facilities and controls.
 - o. Construction waste management and recycling.
 - p. Parking availability.
 - q. Office, work, and storage areas.
 - r. Equipment deliveries and priorities.
 - s. First aid.
 - t. Security.
 - u. Progress cleaning.
 - v. Working hours.
 3. Minutes: Record and distribute meeting minutes.

- C. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

- a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.7 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: Use form included in Section Project Forms.
 1. Identify each page of attachments with the RFI number and sequential page number.
- D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.

- c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 013150 – COVID-19 CONTRACTOR COMPLIANCE

The contents of this Section are **NOT** authored by the Owner, Architect of Record, Engineers of Record, nor the Construction Manager, but are provided as guidelines published by others, including but not limited to, the CDC, OSHA, etc.

- 1.1 In response to the public health emergency for the COVID-19, Governor has declared a State disaster emergency and temporarily suspended or modified laws that would prevent, hinder, or delay action necessary to cope with the disaster or emergency. The Governor has also issued directives to allow for the expansion of certain services including those relating to emergency procurement, and to facilitate the continued work of essential businesses. Under Executive Order 202.6, and as later amended, a construction project is permitted to continue if it is essential. Please refer to Empire State Development (ESD) guidance to determine if your project is essential <https://esd.ny.gov/guidance-executive-order-2026>. The purpose of this guidance is to set forth the recommended practices for all Contractors performing work at construction sites in the context of the COVID-19 health crisis.

A. Contractor Responsibilities:

Under standard contracting agency/authority agreements,

1. Contractors and their subcontractors are always required to guard the safety and health of all persons on and in the vicinity of the work site
2. Contractors and their subcontractors are required to comply with all applicable rules, regulations, codes, and bulletins of the New York State Department of Labor and the standards imposed under the Federal Occupational Safety and Health Act of 1970, as amended (“OSHA”)
3. **The Ossining Union Free School District maintains strict COVID protocols. Each Monday morning at 7:00 am , all prime contractors are required to provide a listing of all construction personnel employed for their contract, whether employed by the prime contractor or subcontractor, who will be onsite that week and their status of vaccinated or non – vaccinated. The listing is to include, 1) The company the worker is employed by, 2) copy of proof of vaccination or 3) a weekly negative test result taken within 72 hours.**
4. Any worker who test positive for COVID 19 or comes in contact with someone who has tested positive for COVID 19 must follow established protocols per the CDC and NYS DOH.
5. Contractors and their subcontractors must comply with all State of New York safety requirements for projects within the State of New York constructed in accordance with the applicable building code, and contractors are required to provide written safety plans for the site showing how all safety requirements of applicable law will be implemented for the duration of the contract
6. Contractors will comply with these requirements as part of their contract, as well as any updates / revisions which are subsequently issued by the governing agencies.

1.2 Contractors and their subcontractors must also adhere to the following practices to help prevent exposure and spread of COVID-19. The following recommendations are based on what is currently known about COVID-19. Contractors and their subcontractors are advised to stay current and immediately implement the most up-to-date practices to protect the safety and health of your employees, clients, and the general public.

A. Contractor Submittals

1. All contractors are required to submit a copy of their own company policy which confirms their compliance with these requirements and demonstrates your workers will properly comply.
2. Include in your submission the name of the designated individual who will be onsite.

B. General Responsibilities:

1. Contractors and their subcontractors should educate their employees on the symptoms of COVID-19, which include cough, fever, trouble breathing, and pneumonia. Contractors and their subcontractors must instruct any employee who feels they may meet the above criteria to refrain from reporting to the jobsite and immediately contact their local health department in the county in which they reside.
2. If the employee begins to exhibit these symptoms while in the workplace, steps should be taken to isolate the individual, place a surgical mask on the individual and inform your local health department and the contracting agency/authority.
3. Personnel should be advised to self-quarantine in accordance with the requirements of the New York State and local health department. Contracting agencies/authorities reserve the right to require any employee of the Contractor, and their subcontractors exhibiting symptoms, to be removed from the jobsite.
4. If an employee is confirmed to have COVID-19 infection, contractors and their subcontractors should inform fellow employees, who have been in contact with this employee, of their possible exposure to COVID-19 in the workplace while maintaining confidentiality as required by applicable New York State and federal law. The fellow employees should then self-monitor for symptoms (i.e., cough, fever, trouble breathing, and pneumonia) and self-quarantine in accordance with the requirements of the New York State and local health department.
5. If an employee tests positive for COVID-19, Contractors and their subcontractors should direct the employee to self-quarantine or remain quarantined for 14 days, following the guidance of New York State and local health department.
6. Contractors and their subcontractors may permit such employee to return to the jobsite when this employee produces a negative COVID-19 test or receives medical clearance to return to work.
7. If an employee tests negative for COVID-19, contractors and their subcontractors may direct the employee to return to work after recovery from their illness. Any direct contacts on pre-cautionary quarantine may return to the jobsite and resume their work activities.

C. Social Distancing:

1. Do not host large group meetings or congregate in large groups. When meetings are necessary, maintain a distance of 6 feet between people
2. Perform any toolbox or other training maintaining the distance of 6 feet between people

3. Perform meetings online or via conference call whenever possible
 4. Only essential personnel should be permitted on the jobsite
 5. Discourage handshaking and other contact greetings
- D. General Jobsite Practices:
1. Procedures and supplies should be in place to encourage proper hand and respiratory hygiene. **(General contractor is required to provide and install a self-contained temporary washing station(s) for use by all workers)**
 - a. Hand Hygiene:

Signage with handwashing procedures should be posted in prominent locations promoting hand hygiene:

 1. Regular handwashing with soap and water for at least 20 seconds should be done:
 - o Before and after eating.
 - o After sneezing, coughing, or nose blowing
 - o After using the restroom
 - o Before handling food
 - o After touching or cleaning surfaces that may be contaminated
 - o After using shared equipment and supplies; and also
 - o Whenever a contractor or subcontractor believes it is necessary
 2. If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60% alcohol
 - b. Respiratory Hygiene:
 1. **ALL EMPLOYEES MUST WEAR FACE MASK PROTECTION AT ALL TIMES TO COVER MOUTH AND NOSE**
 2. Covering coughs and sneezes with tissues or the corner of elbow
 3. Disposing of soiled tissues immediately after use
 2. **At the end of each work shift each Contractor will perform routine environmental cleaning and disinfecting of all frequently touched surfaces on the jobsite.** This includes corridor surfaces, doorknobs, workstations, project trailers and offices, portable toilets, countertops, handles, gang boxes, tools and equipment. See OSHA Guidance on Preparing Workplaces for COVID-19. www.osha.gov/Publications/OSHA3990.pdf
 3. Appropriate cleaning agents and directions should be utilized to perform all cleaning. Ensure all workers are trained on the hazards of cleaning chemicals used in the workplace and comply with all OSHA requirements regarding same in accordance with the Hazard Communication (Global Harmonization) Standard. Information about <https://coronavirus.health.ny.gov/home>
 4. Do not use a common water bottle
 5. If using a common water cooler clean dispenser knob after use
 6. Do not share tools
 7. Utilize personal protection equipment (PPE) for the job being performed
 8. Sanitize reusable PPE per manufacturer's recommendation prior to each use
 9. Do not share PPE
 10. Ensure used PPE and other trash is disposed of properly
 11. Utilize disposable gloves where appropriate and instruct workers to wash hands
 12. Disinfect reusable supplies and equipment

13. Stagger work schedules to minimize the number of people on a job site at any one time
 14. Keep one contractor or subcontractor in an area at a time. Indicate an area is occupied with workers with a sign or flag indicating which contractor or subcontractor is in the area at that time. Remove the sign or flag after completion of work in that area to let others know they may then enter into that area to perform their work. The next contractor or subcontractor will then post their sign or flag to notify others that the area is occupied.
 15. Minimize the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) scheduling work activities to stagger those required to be in any one time to a minimal number of workers.
 16. Avoid cleaning techniques, such as pressurized air or water sprays that may result in generation of bioaerosols
- 1.3 Contracting agencies/authorities may request an updated written safety plan for the site to address practices to help prevent exposure and spread of COVID-19 at the jobsite pursuant to New York State, OSHA recommendations and Centers for Disease Control requirements, which include:
1. Assessment of potential worker exposure hazards, taking into account the specific recommendations and controls for the four levels of worker exposure risk identified in OSHA's Guidance on Preparing Workplaces for COVID-19 (i.e. very high, high, med, Low)
 2. Selecting, implementing, and ensuring the use of control (i.e., social distancing appropriate personal protective equipment, hygiene, and cleaning supplies);
 3. Minimizing the number of workers in an area as much as possible by using indicators of an occupied area (signs or flags) and scheduling work activities to stagger those required to be in any one area to a minimal number of workers.
 4. Minimize entryways into a work area so that employees will be able to observe flagging practices described above. Do not reduce number of emergency exits; and
 5. Additional criteria consistent with health and safety practices at the work site
- 1.4 Project Closure:
1. Where work is suspended on a project, contractors are directed to follow any additional project shut-down protocols as provided by the contracting agency/authority
 2. For NYS Business Reopening Safety Plan Template and Construction Master Guidance Plan please refer to below links:

https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/NYS_BusinessReopeningSafetyPlanTemplate.pdf

<https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/ConstructionMasterGuidance.pdf>

E. For additional resources:

OSHA COVID-19 Resources, OSHA Guidance on Preparing Workplaces for COVID-19

DOL COVID-19 Resources

Centers for Disease Control - - <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

END OF SECTION 013150

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Preliminary Construction Schedule.
 2. Contractor's Construction Schedule.
 3. Submittals Schedule.
 4. Daily construction reports.
 5. Material location reports.
 6. Field condition reports.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- B. Event: The starting or ending point of an activity.
- C. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- D. Major Area: A story of construction, a separate building, or a similar significant construction element.
- E. Milestone: A key or critical point in time for reference or measurement.

1.3 SUBMITTALS

- A. 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.
- B. Submittals Schedule: Submit five (5) copies of schedule. Arrange the following information in a tabular format:
1. Scheduled date for first submittal.
 2. Specification Section number and title.
 3. Submittal category (action or informational).
 4. Name of subcontractor.
 5. Description of the Work covered.
 6. Scheduled date for Architect's final release or approval.
- C. Contractor's Construction Schedule: three (3) printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.
1. Submit an electronic copy of schedule, using software indicated, on compact disc, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated), and date, on label.

1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Within 30 days after Notice to Proceed:
 - a. Structural Steel,
 - b. Soil proctors,
 - c. Concrete mix designs,
 - d. Billet steel shop drawings,
 - e. HVAC components,
 - f. Electrical panels,
 - g. and all other submittals required to commence work and long-lead items critical to job schedule
 - 3. Balance of Submittals - within 60 days after Notice to Proceed.
 - 4. Upon approval by the Architect, non-critical submittals may be transmitted later.
- B. Prepare a written schedule (or log) showing each specification item to be submitted, projected date into architect for review, lead time for procurement and required on job date.
- C. Distribution: Following response to the initial submittal, print and distribute copies for distribution to the Architect, Owner, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- D. Schedule Updating: Revise the submittal schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 2 weeks days after Notice to Proceed is issued.
 - 1. Provide a separate time bar for each significant construction activity. Show ordering and delivery times of all long-lead equipment and materials. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 - 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contracting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
 7. The Architect shall be responsible for coordination of Prime Contractors. Each Prime Contractor is to coordinate the work of each other Prime Contractor so that the work and schedule is not impeded. The contractors shall modify schedules to the Architect's master CPM schedule from commencement of work to completion of work.
- B. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.
- C. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.
1. Refer to Division 1 Section "APPLICATIONS FOR PAYMENT" for cost reporting and payment procedures.
- D. Distribution: Following response to the initial submittal, print and forward copies to the Architect for distribution to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- E. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.
- F. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. High and low temperatures and general weather conditions.
 5. Accidents.
 6. Meetings and significant decisions.
 7. Unusual events (refer to special reports).
 8. Stoppages, delays, shortages, and losses.
 9. Meter readings and similar recordings.

10. Emergency procedures.
 11. Orders and requests of authorities having jurisdiction.
 12. Change Orders received and implemented.
 13. Construction Change Directives received.
 14. Services connected and disconnected.
 15. Equipment or system tests and startups.
 16. Partial Completions and occupancies.
 17. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to, Architect within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3200

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Each Contractor shall develop a full schedule, in sufficient detail and clarity of form and technique so that the contractor can plan and control his work properly and the Construction Manager/Owner can readily monitor and follow the progress for all portions of the work. The Contractor shall complete the detailed schedule within 10 days after contract award.
- B. The schedule shall comply with the various limits imposed by the scope of work any by any contractually intermediate milestone dates and completion dates included in the contract.
- C. The activities identified in the schedule shall be analyzed in detail to determine activity time durations in units of whole working days. All durations shall be the result of definitive manpower and resource planning by the Contractor. The contractor will provide specific manpower loading information / crew size to support the duration proposed. (e.g. – 4-man crew can get 1000 sf / day project has 11000 sf, thus duration was identified as 11 days)
- D. The activity data shall include activity codes to facilitate selection, sorting and preparation of summary reports and graphics. Activity codes shall be developed for:
 - 1. Area: Subdivision of the site into logical modules or blocks and levels.
 - 2. Responsibility: contractor or subcontractor responsible for the work.
 - 3. Specifications: 33 Division CSI format.
 - 4. System: Division of the work into building systems for summary purposes.
 - 5. Milestone: Work associated with completion of interim completion dates or milestones.
 - 6. Pay Item: Work identified with a pay item on the Schedule of Values.

1.2 REPORTS

- A. For initial submittal and each update, the contractor shall prepare the following standard report:
 - 1. Tabular Schedule Report sorted by Activity code and Early Start.

1.3 GRAPHICS

- A. For initial submittal the contractor shall prepare the following graphics:
 - 1. Pure logic diagram (Precedence Format) of entire data, not time scaled, grouped by Activity code.
 - 2. Detailed bar chart sorted by Activity Code with Early Start and Early Finish.
 - 3. Summary bar chart summarizing by Activity Code with Early Start and Early Finish.
- B. For each update the contractor shall prepare the following graphic:
 - 1. Bar Chart showing work activities with Early Start in the next 40 work days sorted by Activity Code and Early Start.
 - 2. Summary Bar Chart summarizing by Activity Code showing progress with Early Start and Early Finish.

- C. For each Change Order involving adjustment in the contract time for performance the contractor shall prepare a pure logic diagram showing the changed work with all predecessor and successor activities (Fragnet).

1.4 SUBMITTALS

- A. In no case shall first application for payment be approved prior to submission of acceptable preliminary schedule, detailed submittal schedule, and schedule of values.
- B. Monthly updates, required schedules and graphics shall be submitted to the Construction Manager/Owner within five working days following the end of the preceding month. Monthly updates, schedules and graphics shall be submitted in five copies.
- C. If any of the required submissions are returned to the Contractor for corrections or revisions, they shall be resubmitted within ten (10) calendar days after the return mailing date. Resubmittals shall be in the same quantities as noted above. Review and response by the Construction Manager/Owner will be given within (10) calendar days after resubmission.

1.5 PAYMENT WITHHELD

- A. If the Contractor fails to submit the required schedule information as indicated in this section within the time prescribed or revision thereof within the requested time, the Construction Manager/Owner may withhold approval of Progress Payment Estimates until such time as the Contractor submits the required information.

1.6 UPDATES

- A. Updates of the Schedule shall be made every two weeks reflecting actual or reasonably anticipated progress as of the last working day of the month. Monthly updates of the Detailed Schedule will be made each month until all work is substantially complete.
- B. The Contractor will meet with the Construction Manager/Owner at the end of the updated period to review information in draft form before preparation of the required schedules and graphics. The Contractor will present data, prepared in advance, for review and approval of the Construction Manager/Owner including:
 - 1. Actual Start Dates.
 - 2. Actual Completion Dates.
 - 3. Activity percent complete and/or Remaining Duration.
 - 4. Revised logic, changes in activity duration's or resource assignments.
 - 5. Narrative report discussing progress through the update period; changes, delays or other circumstances affecting progress; status of the project with respect to completion schedule; and any efforts by the Contractor to improve progress.
- C. The update meeting will establish the values to be submitted for payment and will be directly related to the schedule of values in the application for payment.
- D. The Contractor shall prepare a report of the meeting and make all changes, additions or corrections to the data resulting from the review. The contractor shall promptly prepare the monthly submittal following the update meeting.

1.7 CHANGES, DELAYS AND EXTENSIONS OF TIME

- A. When changes or delays are experienced, the Contractor shall submit to the Construction Manager/Owner a Time Impact Analysis illustrating the influence of each change or delay on the current Contract scheduled completion date. Each time analysis shall include a Fragnet (network analysis) demonstrating how the Contractor proposed to incorporate the change or delay into the Detailed Schedule. Additionally, the analysis shall demonstrate the time impact based on the date the change was given to the Contractor, the status of construction at that point in time, and the activity duration of all effected activities. The activity duration used in this analysis shall be those included in the latest update of the Detailed Schedule, closest to the time of delay or as adjusted by mutual agreement.
- B. Each Time Impact Analysis shall be submitted within ten (10) calendar days after a delay occurs or a notice of change order is given to the Contractor. In cases where the Contractor does not submit a Time Impact Analysis for a specific change or delay with a specified period of time, it shall be mutually agreed that no time extension is required. Final evaluation of each Time Impact Analysis by the Construction Manager/Owner shall be made within fourteen (14) calendar days after receipt unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance shall be made only by written change order approved by the Owner. Upon approval of the Owner, Fragnets illustrating the influence of changes and delays shall be incorporated into the Detailed Schedule by the contractor during the first update after agreement is reached.
- C. The time difference between the Early Finish date and the Late Finish Date is defined as "float." The "float" belongs to the Project and may be used by the Construction Manager/Owner to benefit the Project. Changes or delays that influence activities in the network with "float" and do not extend the Critical Path (the network of activities with zero days "float") shall not be justification for an adjustment in Contract time for performance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 33 00 - SUBMITTALS**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 submittals required for performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Submittal schedule.
 - 3. Daily construction reports.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
 - 7. Quality assurance submittals.
- b. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Permits.
 - 2. Applications for Payment.
 - 3. Performance and payment bonds.
 - 4. Insurance certificates.
 - 5. List of subcontractors.
- c. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Payment Procedures" specifies requirements for submittal of the Schedule of Values.
 - 2. Division 1 Section "Project Management and Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
 - 3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
 - 4. Division 1 Section "Quality Requirements" specifies requirements for submittal of inspection and test reports.
 - 5. Division 1 Section "Execution and Closeout Requirements" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

- a. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of Coordination Drawings is specified in Division 1 Section "Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- b. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- c. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

- a. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - i. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - i. Submittals must be transmitted in accordance with the requirements of Section 1.6.
 - ii. Allow between 10 and 12 business days for initial review of the first round of submittals. See 1.6 for more information. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
 - iii. If an intermediate submittal is necessary, process the same as the initial submittal.
 - iv. Allow an additional 10 business days for reprocessing each resubmittal.
 - v. No extension of Contract Time will be authorized because of contractor's failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
 - vi. **If the contractor delays on key submittals which can negatively impact the project schedule, the owner and his agent(s) can withhold payments as necessary until the proper submittal paperwork is received.**
- b. Submittal Preparation:
 1. Each copy of each submittal will have a "submittal cover sheet" attached identifying all information requested by Architect. (See CPL coversheet in "Project Forms" section). All SCS must be approved by contractor (see electronic stamp B.5) signed, dated and have all fields completely filled-out. Any submittal received without proper use of this Cover Sheet will be returned immediately to the contractor. Cover sheet for contractor's use is included at the end of this section.

2. A Submittals Website, an internet (web-based) service shall be used by all contractors to provide an on-line database and repository which shall be used to transmit and track project related documents. The Submittals Website is provided by the Construction Manager. Upon Contract award the successful bidders will be given log on instructions. The intent for using the Submittals Website is to expedite the construction process by reducing paperwork, improving information flow, and decreasing submittal review turnaround time.
3. Project submittals (shop drawings, product data and quality assurance submittals) shall be transmitted by the Contractor in Portable Document Format (PDF) to the Submittals Website, where it will be tracked and stored for retrieval for review. After the submittal is reviewed it is uploaded back to the Submittals Website for action or use by the Contractor and Owners Representatives.
4. The service also tracks and stores documents related to the project such as RFI's (Request for Information), Contacts, Meeting Minutes, Punchlist, and Non-Compliance notices.
5. For each submittal, the Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents, including verification of manufacturer/product, dimensions and coordination of information with other parts of the work. (contractor sign and date).
6. It is the Contractor's responsibility to provide the submittals in a PDF format. The contractor may use any of the following options:
 - a. Subcontractors and suppliers provide paper submittals to the Contractor, who electronically scans and converts them to PDF format.
 - b. Contract a Scanning Service, which will allow the Contractor and the Contractor's subcontractors and suppliers to provide paper submittals to the Scanning Service, which electronically scans and converts them to PDF format. It will be the Contractor's responsibility to transmit the scanned submittals to the Submittals Website.
7. Image Quality:
 - a. Image resolution: The PDF files shall be created at a minimum resolution of 200 dots per inch utilizing the original document size. The Contractor will be responsible to increase the resolution of the scanned file or images being submitted as required to adequately presenting the information.
 - b. Image Color Rendition: When information represented requires color to convey the intent and compliance, provide full color PDF reproduction.
- c. Contractor Internet Service and Equipment Requirements:
 1. The Contractor will be required to have an Email address and Internet access at Contractor's main office.
 2. Unless the Contractor will exclusively be using a Scanning Service to create all PDF documents, the Contractor will be required to own a PDF reviewing, creating and editing software, such as Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF reviewing, creating and editing software for applying electronic stamps and comments.

3. The Contractor will be required to have a web browser such as Internet Explorer 11, Firefox 30-51.
 4. The Contractor will be required to have Java Run Time Environment: Minimum Java version 8 update 121.
 5. The Contractor will be required to have Adobe Reader version 11: Sage uses a pdf creator to generate forms. In order to print/view forms you will need Adobe Reader.
 6. Contractors are required to have network securities in place such as anti-virus that is active and up to date. Do not access Contract Management from unsecured or public network location such as free WI-FI hotspots.
- d. Training and Support:
1. A training manual shall be available, free of charge from the Construction Manager, for all project participants regarding use of the Submittals Website and PDF submittals.
 2. Training will be provided by the Construction Manager at Arris's main office located in Poughkeepsie, NY (or virtually). The appropriate personnel from each contractor office are required to attend this meeting.
- e. Paper Copies:
1. Contractor Copies: The Contractor will be responsible for making copies, for the Contractors own use and for use by its subcontractors and suppliers.
- f. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the CM electronically using a transmittal form. The CM will then transmit to the Architect. The Architect will not accept submittals received from sources other than the Construction Manager.
1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
 2. Transmittal Form: Use AIA Document G810 and submit Sage notification to ACCI that the submittal has been uploaded. The contractor's transmittal must have the subject description properly filled out, so that all parties can see what section/product is being submitted without having to open the actual submittal.
 3. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- a. Distribution: It is the contractor's responsibility to coordinate submittals with each subcontracting trade (and all prime contractors who have access to Sage). Each contractor shall be required to provide their subcontractors with a complete list of their submittals in order that other contractors can request required submittal information.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

1.6 SUBMITTAL SCHEDULE

- a. Submittals must be prepared and transmitted as follows, unless otherwise approved by the Construction Manager:
 1. Within 15 working days after Notice to Proceed:
 - i. 030131 - Strengthening of Concrete (FRP reinforcing)
 - ii. 051200 / 053100 - Structural Steel Framing & metal Decking
 - iii. 054000- Cold Form Shop drawings
 - iv. 084413 & 085113- Aluminum Windows & Curtainwall
 - v. 233600 - HVAC Units
 - vi. 265100 / 260923 - Lighting Fixtures and Controls
 - vii. Door & Hardware submissions
 - viii. 020800 – Asbestos Abatement Procedures
 - ix. All other submittals critical to the schedule.
 2. Balance of Submittals - after 15 days but within 30 days after Notice to Proceed.
 3. If the contractor misses the milestone submittal time frames listed above, the owner/agents can withhold requisition payments until the required paperwork is received.
If there are any open submittals beyond 60 days of contract award, the owner will stop all contractor payments until all missing paperwork is received.
 4. Upon approval by the Construction Manager, non-critical submittals may be transmitted later.
 5. Prepare submittals including information in paragraph 1.4B above.
- b. Schedule Updating: Revise the submittal schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

- a. Prepare a daily construction report recording the following information concerning events at the site, and submit via email to the Architect and Construction Manager by 10:00 am the following day. Any contractor not submitting required reports will not receive approval on the subsequent application for payment until such time that all required information is submitted:
 1. List of subcontractors at the site.
 2. Count of personnel at the site (substantiates payroll).
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, and losses.
 7. Meter readings and similar recordings.
 8. Emergency procedures.
 9. Orders and requests of governing authorities.
 10. Change Orders received, implemented.

11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

- a. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- b. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
 1. Dimensions.
 2. Identification of products and materials included by sheet and detail number.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
 7. All Technical Submittals:
 - i. Electronic shop drawing submittal to Construction Manager.
 8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
 9. Maintain approved copies on site to record "as-built" conditions.
 10. Submit additional copies of as-built, approved drawings as specified in project closeout.

1.9 PRODUCT DATA

- a. Collect Product Data into a single submittal for each element of construction or system. Submit prior to shop drawings or simultaneously when products are specified items or A/E approval is granted. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following that are not required, mark copies to indicate the applicable information. Include the following information:
 - i. Manufacturer's printed recommendations.
 - ii. Compliance with trade association standards.
 - iii. Compliance with recognized testing agency standards.
 - iv. Application of testing agency labels and seals.
 - v. Notation of dimensions verified by field measurement.
 - vi. Notation of coordination requirements.
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Submit digitally through the Submittals Website to CM.

4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - i. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - ii. Do not permit use of unmarked copies of Product Data in connection with construction.
- 1.10 SAMPLES
- a. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern. Samples are submitted directly to the architect's home office and copy Construction Manager with transmittal.
 1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
 - i. Specification Section number and reference.
 - ii. Generic description of the Sample.
 - iii. Sample source.
 - iv. Product name or name of the manufacturer.
 - v. Compliance with recognized standards.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - i. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - ii. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - iii. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 - iv. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
 3. Preliminary Submittals: Submit a full set of choices where Samples are required for selection of color, pattern, texture, or similar characteristics from a range of standard and premium choices.
 - i. The Architect will review and distribute selections made or other action.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 6 sets to the Architect who will distribute one set to CM and two (2) to the contractor marked with the action taken.

5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - i. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - ii. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- b. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish to Project standard.
 - i. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

- a. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- b. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- c. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.12 ARCHITECT'S ACTION

- a. Except for submittals for the record or information, where action and return are required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility, as stated on the approval stamp.
- b. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
 1. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.
 2. Final Unrestricted Release: When the Architect marks a submittal "Furnish as Corrected," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 3. Final-But-Restricted Release: When the Architect marks a submittal "Make Corrections Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance. (No resubmittal is required).
 4. "Revise and Resubmit" When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication,

delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay.

5. Returned for Resubmittal: When the Architect marks a submittal "Rejected," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary, to obtain different action mark.
 - i. Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where Work is in progress.
6. Other Action: Where a submittal is for information or record purposes only and does require approval and the contractor is responsible for the conformance of the product, the Architect will return the submittal marked "Reviewed."
7. "Submit specified item": When submittal is marked "Submit Specified Item," the Contractor shall immediately submit the specified item.

PART 2 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 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.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect 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.

1.4 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. 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.
 2. Notify Architect seven 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 approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 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.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 16.

1.6 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 retesting and reinspecting 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. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Manufacturer's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.7 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 1. Notifying Architect 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 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 reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- A. Any agencies which has the proper qualifications and certifications to perform the test and or inspection.

3.2 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 4119– SED REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes: “**Uniform Safety Standards for School Construction and Maintenance Projects**” for maintaining a Certificate of Occupancy during construction.

1.2 REFERENCES

- A. Section 155.5 of the Regulations of the New York State Commissioner of Education “Uniform Safety Standards for School Construction and Maintenance Projects”.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENT

- A. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

3.2 HAZARDOUS BUILDING MATERIALS

- A. Surfaces that will be disturbed during renovation or demolition have been tested for lead and asbestos. Results of the testing are available, upon request, from the Owner.

3.3 GENERAL SAFETY AND SECURITY STANDARDS FOR CONSTRUCTION PROJECTS.

- A. General safety and security standards for construction projects include the following:
1. All construction materials shall be stored in a safe and secure manner.
 2. Fences around construction supplies or debris shall be maintained.
 3. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
 4. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
 5. Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites.

3.4 SEPARATION OF CONSTRUCTION AREAS FROM OCCUPIED AREAS

- A. Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.
1. A specific stairwell and/or elevator shall be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for students or school staff.

2. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.
3. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session."

3.5 MAINTAINING EXITING AND EGRESS DURING CONSTRUCTION

- A. The Contractor will prepare a plan detailing how exiting and egress required by the applicable building code will be maintained during construction. The plan shall indicate temporary construction required to isolate construction equipment, materials, people, dust, fumes, odors, and noise during the construction period. Temporary construction details shall meet code-required fire ratings for separation and corridor enclosure. At a minimum, required exits, temporary stairs, ramps, exit signs, and door hardware shall be provided at all times.

3.6 MAINTAINING VENTILATION DURING CONSTRUCTION

- A. The Contractor will prepare a plan detailing how adequate ventilation will be maintained during construction. The plan shall indicate ductwork that must be rerouted, disconnected, or capped in order to prevent contaminants from the construction area from entering the occupied areas of the building. The plan shall also indicate how required ventilation to occupied spaces affected by the construction will be maintained during the project.

3.7 NOISE ABATEMENT DURING CONSTRUCTION

- A. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken
- B. Noise level measurements (dba) shall be taken with a type 2 sound level meter in the occupied space in a location closest to the source of noise.
- C. Each prime contractor shall have a type 2 sound level meter available on the project site at all times for use by the architect/engineer for the entire duration of the construction project.

3.8 CONTROL OF CHEMICAL FUMES, GASES AND OTHER CONTAINMENTS DURING CONSTRUCTION

- A. The contractor shall be responsible for the control of chemical fumes, gases, and other contaminants produced by, including but not limited to, welding, gasoline or diesel engines, roofing, paving, or painting, to ensure they do not enter occupied portions of the building or air intakes.
 1. Contractors shall provide a plan indicating how and where welding, gasoline engine, roofing, paving, painting or other fumes will be exhausted from the work site. Contractors shall provide all temporary means to assure that fresh air intakes do not draw in such fumes.
 2. If any portion of the work will generate toxic gases that cannot be contained in an isolated area, the work shall be done when school classes and programs are not in session. The contractor shall include costs associated with this requirement in his bid. The building shall be properly ventilated and, the material shall be given proper time, as recommended by the manufacturer, to cure "off-gas" before re-occupancy.

3. The contractor shall maintain all manufacturers' Material Safety Data Sheets (MSDS) at the site for all products used in the project. Copies of the MSDS sheets shall be given to the Architect and to the School District. MSDS sheets shall be provided to anyone who requests them.

3.9 CONTROL OF OFF-GASSING DURING CONSTRUCTION

- A. The contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers recommendations before a space can be occupied.
 1. Contractor shall provide, in their schedules for work of the construction, proper time for "off-gassing" or volatile organic compounds introduced during construction before occupancy is allowed. Specific attention is warranted for activities including glues, adhesives, paint, furniture, carpeting, wall coverings, and drapery. Manufacturers shall be contacted to obtain information regarding appropriate temperatures and times needed to cure or ventilate the product during use and before safe occupancy of the space can be assured. The contractor shall include the above-mentioned information and shall clearly highlight the information, as part of the shop drawing submittal.
 2. Building materials or furnishings which "off-gas" chemical fumes, gases, or other contaminants shall be aired out in a well ventilated heated warehouse before it is brought to the project for installation or, the manufacturer's recommended "off-gassing" periods must be scheduled between installation and use of the space.
 3. The contractor shall maintain all manufacturers' Material Safety Data Sheets (MSDS) at the site for all products used in the project. Copies of the MSDS sheets shall be given to the Architect and to the School District. MSDS sheets shall be provided to anyone who requests them.

3.10 ASBESTOS CONTAINING BUILDING MATERIALS

- A. Large and small asbestos abatement projects as defined by 12NYCRR56 shall not be performed while the building is occupied. The term "building", as referenced in this section, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier.
- B. Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.
- C. For clearance sampling, the air sampling technician shall provide aggressive air sampling per Rule 56 and as follows: First direct the exhaust of a leaf blower, against all walls, ceilings, floors, ledges, and other surfaces in the work area. Continue agitation for at least five minutes per every 1,000 sf of floor space. Following this aggressive agitation, the air-sampling technician shall use at least one 20-inch fan per 10,000 cubic feet of work area space for continuous agitation. The fan shall be operated on low speed and pointed toward the ceiling. Sampling pumps shall be started after the fans are started and stopped before the fans are stopped.
 1. Samples shall be logged on a permanently bound logbook at the laboratory. No whiteout will be used to make corrections.
 2. All lab counts, data and analysis shall be recorded on a lab summary sheet for each sample.
 3. Per the requirements of the New York State Education Department all Final Air Clearance Samples shall be (TEM) Transmission Electron Microscopy Methodology..

3.11 LEAD CONTAINING BUILDING MATERIALS

- A. Surfaces that will be disturbed by reconstruction have a determination made indicating No Lead Present.
 - 1. Projects which disturb surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD Guidelines.

END OF SECTION 01 4119

SECTION 01 4120 - WORK RESTRICTIONS

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 USE OF PREMISES

- A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
1. Owner Occupancy: Allow for Owner occupancy of the entire site and building. The Owner's educational programs shall continue throughout the duration of construction. No work shall be done while school is in session.
 2. 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.
 - 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.
- B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.3 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.
- B. Partial Owner Occupancy: Owner reserves the right to occupy and to place and install equipment in completed areas of all buildings, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will provide, operate, and maintain mechanical and electrical systems serving occupied portions of building.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4120

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
1. Definitions of construction-related terms that are not defined in the Construction Documents.
 2. An alphabetical listing of organizations and agencies that publish recognized industry standards referred to in the Contract Documents.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Air Handling Unit: A blower or fan used for the purpose of distributing supply air to a room, space or area.
- C. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- D. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved according to the requirements established in this Section and as required by the Code Official having jurisdiction over this project.
- E. Architect: Other terms including "Architect/Engineer" and "Engineer" have the same meaning as "Architect".
- F. Company Field Adviser: An employee of the Company which lists and markets the primary components of the system under the name who is certified in writing by the Company to be technically qualified in design, installation, and servicing of the required products or an employee of an organization certified by the foregoing Company to be technically qualified in design, installation, and servicing of the required products. Personnel involved solely in sales do not qualify.
- G. Concealed Location: A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.
- H. Concealed Piping: Piping that is located in a concealed location. (See "concealed location".)
- I. Connect: A term contraction and unless otherwise specifically noted is to mean "The labor and materials necessary to join or attach equipment, materials or systems to perform the functions intended".
- J. Directed: A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- K. Drain: Any pipe that carries wastewater or water-borne wastes in a building drainage system.
- L. Drainage Fittings: Type of fitting or fittings utilized in the drainage system. Drainage fittings are similar to cast-iron fittings, except that instead of having a bell and spigot, drainage fittings are recessed and tapped to eliminate ridges on the inside of the installed pipe.
- M. Drainage System: Piping within a public or private premise that conveys sewage, rainwater or other liquid wastes to a point of disposal. A drainage system does not include the mains of a public sewer system or a private or public sewage treatment or disposal plant.
1. Building Gravity: A drainage system that drains by gravity into the building sewer.

2. Sanitary: A drainage system that carries sewage and excludes storm, surface and ground water.
 3. Storm: A drainage system that carries rainwater, surface water, condensate, cooling water or similar liquid wastes.
- N. Duct: A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.
- O. Duct System: A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.
- P. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- Q. Furnish: Supply and deliver to Project site, or other designated location, all materials and equipment so specified, ready for unloading, unpacking, assembly, installation, and similar operations or other form of incorporation into the Project, and maintained ready for use. Supply into other elements of the Project directly to the fabricator, installer or manufacturer as required.
- R. Headroom: Minimum clearance between the floor and the underside of the point of lowest installed mechanical construction above. In case of stairways and walkways, the minimum clearance between the step or surface of the walkway and the lowest installed mechanical construction above the stairway or the walkway.
- S. Include: When used in any form other than "inclusive", is non-limiting and is not intended to mean "all-inclusive."
- T. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- U. Inspection Certificate: An identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency.
- V. Install: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- W. Installer: An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
 2. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

- a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.
- X. Label: An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency.
- Y. Location:
 - 1. Damp Location: Partially protected locations under canopies, marquees, roofed open porches and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns and some cold-storage warehouses.
 - 2. Dry Location: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
 - 3. Wet Location: Installations underground or in concrete slabs or masonry in direct contact with the earth and locations subject to saturation with water or other liquids, such as vehicle-washing areas, and locations exposed to weather and unprotected.
- Z. Manufacturer's Designation: Identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also "Inspection Certificate," "Label" and "Mark").
- AA. Mark: An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also "Inspection Certificate," "Label" and "Manufacturer's Designation").
- BB. Mechanical: Other terms including "HVAC", "Plumbing", "Sprinkler", "Laboratory Equipment", "Food Service Equipment", "Laundry Equipment", and "Refrigeration" have the same meaning as "Mechanical".
- CC. Owner: Ossining Union Free School District.
- DD. Piping: This term includes pipe, tube and appurtenant fittings, flanges, valves, traps, hangers and supports.
- EE. Piping, Concealed: Piping built into construction and not accessible without removal of construction Work such as masonry, plaster or other finish material, and piping installed in floors, furred spaces, suspended ceilings, non-walk-in tunnels, conduits, and behind removable panels and cabinet doors.
- FF. Piping, Distribution: Domestic water supply piping, starting with a connection to service piping, and continuing throughout the building to point of connection to equipment and fixture supply piping.
- GG. Piping, Exposed: Piping directly accessible by normal accesses without removal of any construction Work or material.
- HH. Piping, Service: Underground domestic water supply piping with a connection to a water main or supply as noted, and continuing to and into a building and terminating with the exposed fitting inside the building.
- II. Piping, Tunnel: Piping installed in walk-in or non-walk-in tunnels or conduits up to first shut-off valve inside building.

- JJ. Plumbing System: Includes the water supply and distribution pipes; plumbing fixtures and traps; water-treating or water-using equipment; soil, waste and vent pipes; and sanitary and storm sewers and building drains, in addition to their respective connections, devices and appurtenances within a structure or premises.
- KK. Product: As used includes materials, systems and equipment.
- LL. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- MM. Provide: Furnish and install, complete and ready for the intended use.
- NN. Registered Design Professional: An individual who is a registered architect (RA) in accordance with Article 147 of the New York State Education Law or a licensed professional engineer (PE) in accordance with Article 145 of the New York State Education Law.
- OO. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- PP. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- QQ. Replace: Remove designated, damaged, rejected, defective, unacceptable, or non-conforming work from the Project and provide new work meeting the requirements of the Contract Documents in place thereof.
- RR. Space, Finished: A space which has a finishing material applied to walls or ceilings, such as paint, plaster, ceramic tile, enamel glazing, face brick, vinyl wall covering, etc. to provide a finished appearance or which will have such finishes applied under a related Contract.
- SS. Space, Unfinished: A space which does not meet the definition of a finished space.
- TT. Special Inspection: Inspection as herein required of the materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.
- UU. Sprayed Fire-Resistant Materials: Cementitious or fibrous materials that are spray-applied to provide fire-resistant protection of the substrates.
- VV. Steam-Heating Boiler A boiler operated at pressures not exceeding 15 psi for steam.
- WW. Supplier: Any person or organization who supplies materials or equipment for the work, including that fabricated to a special design.
- XX. Utility: Any gas, steam, water, sanitary sewer, storm sewer, electrical or other such service.
- YY. Water Supply System: The water service pipe, water distribution pipes, and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the structure or premises.
1. Chilled: Water-cooled by refrigeration.
 2. Cold: Water with at temperature between 33 degrees F and 80 degrees F and which is neither cooled nor heated mechanically.
 3. Domestic: Water for use in buildings, except water used in connection with space heating and space cooling.
 4. High Temperature: Water with a supply water temperature above 350 degrees.
 5. Hot: Water at a temperature greater than or equal to 110°F.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. 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.
- D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
- E. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
 - 1. ADAAG Americans with Disabilities Act (ADA); www.access-board.gov
Accessibility Guidelines for Buildings and Facilities
Available from Access Board
 - 2. CFR Code of Federal Regulations; www.access.gpo.gov/nara/cfr
Available from Government Printing Office
 - 3. CRD Handbook for Concrete and Cement
Available from Army Corps of Engineers
Waterways Experiment Station; www.wes.army.mil
 - 4. FS Federal Specification
Available from General Services Administration;
www.fss.gsa.gov/pub/fed-specs.cfm
 - 5. UFAS Uniform Federal Accessibility Standards
Available from Access Board; www.access-board.gov

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
 - 1. AA Aluminum Association, Inc. (The); www.aluminum.org
 - 2. AABC Associated Air Balance Council; www.aabchq.com
 - 3. AAMA American Architectural Manufacturers Association; www.aamanet.org
 - 4. ACI American Concrete Institute/ACI International; www.aci-int.org
 - 5. ADC Air Diffusion Council; www.flexibleduct.org
 - 6. AGA American Gas Association; www.aga.org

7. AIA American Institute of Architects (The); www.aia.org
8. AISC American Institute of Steel Construction; www.aisc.org
9. AISI American Iron and Steel Institute; www.steel.org
10. AMCA Air Movement and Control Association International, Inc.; www.amca.org
11. ANSI American National Standards Institute; www.ansi.org
12. APA APA - The Engineered Wood Association; www.apawood.org
13. ARI Air-Conditioning & Refrigeration Institute; www.ari.org
14. ASCE American Society of Civil Engineers; www.asce.org
15. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org
16. ASME ASME International; www.asme.org
17. ASSE American Society of Sanitary Engineering; www.asse-plumbing.org
18. ASTM American Society for Testing and Materials; www.astm.org
19. AWI Architectural Woodwork Institute; www.awinet.org
20. AWCI Association of the Wall and Ceiling Industries International; www.awci.org
21. AWPAA American Wood-Preservers' Association; www.awpa.com
22. AWS American Welding Society; www.aws.org
23. BHMA Builders Hardware Manufacturers Association; www.buildershardware.com
24. BIA Brick Industry Association (The); www.bia.org
25. CISCA Ceilings & Interior Systems Construction Association; www.cisca.org
26. CISPI Cast Iron Soil Pipe Institute; www.cispi.org
27. CRI Carpet & Rug Institute (The); www.carpet-rug.com
28. CRSI Concrete Reinforcing Steel Institute; www.crsi.org
29. CSI Construction Specifications Institute (The); www.csinet.org
30. DHI Door and Hardware Institute; www.dhi.org
31. EIA/TIA Electronic Industries Alliance/Telecommunications Industry Association; www.eia.org
32. FGMA Flat Glass Marketing Association
33. FMG FM Global; www.fmgglobal.com
34. GA Gypsum Association; www.gypsum.org
35. GANA Glass Association of North America; www.glasswebsite.com/gana
36. IEEE Institute of Electrical and Electronics Engineers, Inc.; www.ieee.org
37. IESNA Illuminating Engineering Society of North America; www.iesna.org
38. IGCC Insulating Glass Certification Council; www.igcc.org
39. ITS Intertek Testing Services; www.itsglobal.com
40. LSGA Laminated Safety Glass Association(See GANA)
41. NAAMM National Association of Architectural Metal Manufacturers; www.naamm.org
42. NAIMA North American Insulation Manufacturers Association; www.naima.org
43. NCMA National Concrete Masonry Association; www.ncma.org
44. NECA National Electrical Contractors Association; www.necanet.org
45. NEMA National Electrical Manufacturers Association; www.nema.org
46. NFPA National Fire Protection Association; www.nfpa.org
47. NFRC National Fenestration Rating Council; www.nfrc.org
48. NGA National Glass Association; www.glass.org
49. NRCA National Roofing Contractors Association; www.nrca.net
50. PCI Precast/Prestressed Concrete Institute; www.pci.org
51. PDI Plumbing & Drainage Institute; www.pdionline.org
52. RFCI Resilient Floor Covering Institute
53. RMA Rubber Manufacturers Association; www.rma.org
54. SDI Steel Deck Institute; www.sdi.org
55. SDI Steel Door Institute; www.steeldoor.org

56. SIGMA Sealed Insulating Glass Manufacturers Association;
www.sigmaonline.org/sigma
 57. SJI Steel Joist Institute; www.steeljoist.org
 58. SMACNA Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org
 59. SSMA Steel Stud Manufacturers Association; www.ssma.com
 60. SSPC SSPC: The Society for Protective Coatings; www.sspc.org
 61. SWI Steel Window Institute; www.steelwindows.com
 62. TCA Tile Council of America, Inc.; www.tileusa.com
 63. UL Underwriters Laboratories Inc.; www.ul.com
 64. WDMA Window & Door Manufacturers Association; www.wdma.com
 65. WWPA Western Wood Products Association; www.wwpa.org
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. ICC International Code Council, Inc.; www.intlcode.org
 - a. Building Code of New York State
 - b. Energy Conservation Construction Code of New York State
 - c. Fire Code of New York State
 - d. Fuel Gas Code of New York State
 - e. Mechanical Code of New York State
 - f. Plumbing Code of New York State
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. CE Army Corps of Engineers; www.usace.army.mil
 2. CPSC Consumer Product Safety Commission; www.cpsc.gov
 3. DOC Department of Commerce; www.doc.gov
 4. EPA Environmental Protection Agency; www.epa.gov
 5. FAA Federal Aviation Administration; www.faa.gov
 6. FDA Food and Drug Administration; www.fda.gov
 7. GSA General Services Administration; www.gsa.gov
 8. HUD Department of Housing and Urban Development; www.hud.gov
 9. NIST National Institute of Standards and Technology; www.nist.gov
 10. OSHA Occupational Safety & Health Administration; www.osha.gov
- D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. NYSDOL New York State Department of Labor; www.labor.state.ny.us/
 2. NYSED New York State Education Department, www.nysed.gov
 3. OCFS Office of Children & Family Services; www.ocfs.state.ny.us/main/
 4. OMH Office of Mental Health; www.omh.state.ny.us/

PRODUCTS (Not Used)

PART 2 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 4533 STATEMENT OF SPECIAL INSPECTIONS AND TESTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Attached is NYS Education Department Statement of Special Inspections and Tests.
 - 1. The document is provided for the Contractor's reference.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4533

 NYS EDUCATION DEPARTMENT Office of Facilities Planning 89 Washington Avenue, Room 1060 EBA Albany, NY 12234	STATEMENT OF SPECIAL INSPECTIONS AND TESTS As required by the Building Code of NYS (BCNYS)
BCNYS § 1704.1.1 requires the project Design Professional to complete the Statement of Special Inspections and Tests. Completion of the Statement of Special Inspections & Tests and submission to the Office of Facilities Planning with the Construction Permit Application is a condition for issuance of the Building Permit.	
School District Ossining Union Free School District	Building Ossining High School
Project Title 3rd Floor Connector	
SED Project # 66-14-01-03-0-003-040	Project Address 29 S. Highland Avenue, Ossining, NY 10562
Architect/Engineer Clark Patterson Lee	
Name of Person Completing this Statement Brian S. Cooney, P.E.	Phone 800-274-9000
	Date 3/12/2021
Comments	

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
A. Steel Construction						
1. Material verification of high-strength bolts, nuts and washers.		X	Applicable ASTM material specifications. AISC 360, Section A3.3	1704.3	☒	
2. Inspection of high-strength bolting.	X	X	AISC 360, Section M2.5	1704.3, 1704.3.3	☒	
3. Material verification of structural steel.			ASTM A 6 or A 568	1704.3, 1708.4	☒	
4. Material verification of weld filler materials.			AISC 360, Section A3.5	1704.3	☒	
5. Inspection of welding:				1704.3	☒	
a. Structural steel	X	X	AWS D1.1, D1.3	1704.3, 1704.3.1	☒	
b. Reinforcing steel	X	X	AWS D1.4; ACI 318: 3.5.2	1704.3	☐	
6. Inspection of steel frame joint details.		X		1704.3, 1704.3.2	☐	
B. Concrete Construction						
1. Inspection of reinforcing steel, including prestressing tendons, and placement.		X	ACI 318: 3.5, 7.1-7.7	1704.4, 1913.4	☒	
2. Inspection of reinforcing steel welding.			AWS D1.4; ACI 318: 3.5.2	1704.4	☐	

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
3. Inspection of bolts to be installed in concrete prior to and during placement.	X			1704.4	☐	
4. Verify use of required design mix.		X	ACI 318: Ch. 4, 5.2-5.4	1704.4, 1904.2.2, 1913.2, 1913.3	☒	
5. Sampling fresh concrete: slump, air content, temperature, strength test specimens.	X		ASTM C 172, C 31; ACI 318: 5.6, 5.8	1704.4, 1913.10	☒	
6. Inspection of placement for proper application techniques.	X		ACI, 318: 5.9, 5.10	1704.4, 1913.6, 1913.7, 1913.8	☐	
7. Inspection for maintenance of specified curing temperature and techniques.		X	ACI, 318: 5.11 - 5.13	1704.4, 1913.9	☒	
8. Inspection of prestressed concrete.	X		ACI 318: 18.18.4, 18.20	1704.4	☐	
9. Erection of precast concrete members.		X	ACI 318: Ch. 16	1704.4	☐	
10. Verification of in-situ concrete strength prior to stressing of tendons and prior to removal of shores and forms from beams and slabs.		X	ACI 318: 6.2	1704.4	☐	
11. Inspection of formwork		X	ACI 318: 6.1.1		☐	
C. Masonry Construction						
L1 = Level 1 Inspection required for nonessential facilities.			ACI 530/ASCE 5/TMS 402, Ch. 35	ACI 530.1/ASCE 6/TMS 602, Ch. 35	☐	
L2 = Level 2 Inspection required for essential facilities. In general, schools are not considered essential facilities unless they are a designated emergency shelter			ACI 530/ASCE 5/TMS 402, Ch. 35	ACI 530.1/ASCE 6/TMS 602, Ch. 35	☐	

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD		BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
1. Verify to ensure compliance:							
a. Proportions of site prepared mortar and grout.		L1 & L2		2.6A	1704.5	☐	
b. Placement of masonry units and construction of mortar joints.		L1 & L2		3.3B	1704.5	☐	
c. Location and placement of reinforcement, connectors, tendons, anchorages.		L1	Sec. 1.13	3.4, 3.6A	1704.5	☐	
		L2		3.4, 3.6A	1704.5	☐	
d. Prestressing technique.		L1		3.6B	1704.5	☐	
Grout space prior to grouting.	L2			3.2D	1704.5	☐	
e. Grade and size of prestressing tendons and anchorages.		L1		2.4B, 2.4H	1704.5	☐	
Placement of grout.	L2			3.5	1704.5	☐	
f. Grout specs prior to grouting.	L2			3.6 C	1704.5	☐	
2. Inspection program shall verify:							
a. Size and location of structural elements.		L1 & L2		3.3G	1704.5	☐	
b. Type, size, and location of anchors.	L2	L1	Sec. 1.2.2(e), 2.1.4, 3.1.6		1704.5	☐	
c. Specified size, grade, and type of reinforcement.		L1 & L2	Sec. 1.13	2.4, 3.4	1704.5	☐	
d. Welding of reinforcing bars.	L1 & L2		2.1.7.10.2, 3.3.3.4(b)		1704.5	☐	
e. Cold/hot weather protection of masonry construction.		L1 & L2		1.8C, 1.8D	1704.5, 2104.3, 2104.4	☐	
f. Prestressing force measurement and application.	L2	L1		3.6B	1704.5	☐	
3. Verification prior to grouting.	L2	L1	1.13	3.2D, 3.4, 2.6B, 3.3B 1.4	1704.5, 2105.2.2, 2105.3	☐	
4. Grout placement.	L1			3.5, 3.6C	1704.5	☐	

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
5. Preparation of grout specimens, mortar specimens, and/or prisms.	L1 & L2		1.4	1704.5, 2105.2.2, 2105.3	☐	
6. Compliance with documents and submittals.		L1 & L2	1.5	1704.5	☐	
D. Wood Construction						
1. Fabrication process of prefabricated wood structural elements and assemblies.				1704.6, 1704.2	☐	
2. High-load diaphragms designed in accordance with Table 2306.3.2				1704.6.1, 1704.1	☐	
E. Soils				1704.7	☐	
F. Pile Foundations				1704.8	☐	
G. Pier Foundations				1704.9	☐	
H. Sprayed Fire-Resistant Materials						
1. Structural member surface conditions.				1704.10.1	☐	
2. Application.				1704.10.2	☐	
3. Thickness.			ASTM E 605	1704.10.3	☐	
4. Density.			ASTM E 605	1704.10.4	☐	
5. Bond strength.			ASTM E 736	1704.10.5	☐	
I. Mastic and Intumescent Fire-Resistant Coatings				1704.11	☐	
J. Exterior Insulation and Finish Systems (EIFS)				1704.12	☐	
K. Special Cases				1704.13	☐	
L. Smoke Control				1704.14	☐	
M. Special Inspections for Seismic Resistance						
1. Structural steel.	X		AISC 341	1707.2	☐	
2. Structural wood.	X			1707.3	☐	
3. Cold-formed steel framing.		X		1707.4	☐	
4. Pier Foundations.		X		1707.5	☐	
5. Storage racks and access floors.		X		1707.6	☐	

INSPECTION AND TESTING (Continuous & Periodic is as Defined by the BCNYS)	CONTINUOUS	PERIODIC	REFERENCE STANDARD	BCNYS REFERENCE	CHECK IF REQUIRED	IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY
6. Architectural components.		X		1707.7	☐	
7. Mechanical and electrical components.		X		1707.8	☐	
8. Designated seismic system verifications				1707.9	☐	
9. Seismic isolation system.		X		1707.10	☐	
N. Structural Testing for Seismic Resistance						
1. Testing and verification of masonry materials and assemblies prior to construction.				1708.1	☐	
2. Testing for seismic resistance.				1708.2	☐	
3. Reinforcing and prestressing steel.			ACI 318	1708.3	☐	
4. Structural steel.			AISC 341, AWS D1.1	1708.4	☐	
5. Seismic qualification of mechanical and electrical equipment.				1708.5	☐	
6. Seismically isolated structures.			Section 17.8 of ASCE 7	1708.6	☐	
O. Structural Observations						
1. Seismic resistance.				1709.2	☐	
2. Wind requirements.				1709.3	☐	
P. Test Safe Load				1712	☐	
Q. In-Situ Load Tests				1713	☐	
R. Preconstruction Load Tests				1714	☐	
S. Other (list)					☐	

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water Service and distribution.
 - 2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 3. Ventilation.
 - 4. Electric power service.
 - 5. Lighting.
- C. Security and protection facilities include, but are not limited to, the following:
 - 1. Environmental protection.
 - 2. Stormwater control.
 - 3. Tree and plant protection.
 - 4. Site enclosure fence.
 - 5. Security enclosure and lockup.
 - 6. Barricades, warning signs, and lights.
 - 7. Covered walkways
 - 8. Temporary enclosures.
 - 9. Temporary partitions.
 - 10. Fire protection.
- D. Unless work of this section is indicated to be provided under a specific contract, each Prime Contractor must provide, maintain and remove required temporary facilities necessary to perform his own construction activities.
- E. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.2 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department, and rescue squad rules.

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5. Environmental protection regulations.
6. NYS SED 155.5
- B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations,” ANSI A10 Series standards for “Safety Requirements for Construction and Demolition,” and NECA Electrical Design Library “Temporary Electrical Facilities.”
 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code.”
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.3 PROJECT CONDITIONS

- A. Temporary Utilities: Each contractor will prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-preventive measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

1.4 DIVISION OF RESPONSIBILITIES

- A. General: These Specifications assign the Contractor responsibilities.
- B. Each Prime Contractor is responsible for the following:
 1. Installation, operation, maintenance and removal of each temporary facility considered as its own normal construction activity, as well as the costs and use charges except as listed below.
 2. Protection for existing site surfaces (asphalt, sidewalks, plantings, etc.) each contractor is responsible to ensure that their activities do not damage in any way.
 3. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 4. Its own storage, Conex boxes and fabrication sheds. (Locate / Move as directed by CM)
 5. Hoisting requirements, including hoisting loads in excess of 2 tons, hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure. (Rigging insurance must be provided when contractor hoisting equipment)
 6. Collection and disposal of its own hazardous, dangerous, unsanitary, and all waste material.
 7. Secure lock-up of its own tools, materials and equipment.
 8. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
 9. Maintaining temporary facilities provided by Contractor.

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10. Complying with the regulations of the Commissioner of Education - 8 NYCRR 155.5 - Uniform Safety Standards for School Construction and Maintenance Projects specified in Division 1
11. Containers for non-hazardous waste and debris generated by their own demolition and construction operations.

1.5 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner, Architect or Construction Manager and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 1. The Architect and Construction Manager
 2. Other Contractors.
 3. Owners construction forces, including testing agencies
 4. Personnel of authorities having jurisdiction.
- B. Water Service: Use water from the Owner's existing water system without metering and without payment of use charges. Access to water shall be approved by the Owner.
- C. Electric Power Service: Temporary electric power including set-up and maintenance is the responsibility of the Electrical Contractor. Use charges by owner

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. General: Provide new materials. If acceptable to the Architect / CM, the Contractor may use undamaged, previously used materials in good condition. Provide materials suitable for use intended.
- B. Lumber and Plywood:
 1. For signs and directory boards, provide exterior-type, Grade B-B high density concrete form overlay plywood of sizes and thicknesses indicated.
 2. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.
- C. Paint: Paint surfaces exposed to view from Owner occupied areas.
- D. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- E. Temporary Roofing – minimum ½” gypsum sheeting and 30 mil reinforced EPDM membrane.

2.2 EQUIPMENT

- A. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

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- B. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Protect adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

3.2 CONTRACTOR FIELD OFFICES

- A. **Space onsite is severely limited.** Contractor may with permission from the architect and construction manager establish field office in the staging area. Said office for the individual prime contractor shall be of such size and design as approved by the owner and Construction Managers designated staging area. Each representative contractor will arrange for telephone service and electric service, if required, directly with the utility company. (No field offices or storage trailers will be allowed by the buildings.). **Contractors will not be allowed to park in the school's parking lot when school is in session.**
- B. Maintain, in the contractor's field office, all articles for First Aid treatment. The contractor shall also establish standing arrangements for the immediate removal and hospital treatment of any employees and other persons on the job site who may be injured or who may become ill during the course work.

3.3 TEMPORARY AND PERMANENT SERVICES, GENERAL

- A. The Contractor's use of any permanent system or service of the building or portions thereof shall be subject to the Owners approval.
- B. The Contractor shall be responsible for any and all damage to permanent services used, and shall make good any and all damage to the satisfaction of the owner, prior to final completion and acceptance.
- C. NOTE - In accordance with OSHA and other applicable regulations, the representative Contractors performing erection of "skeleton" type work are solely responsible for the netting, guard rail protection and such other safety devices as deemed necessary to protect the workers and public from harm.

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3.4 TEMPORARY LIGHT AND POWER

- A. Temporary Electric Power Service: **Electrical Contractor** shall provide and pay all costs to provide a weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period.
1. Responsibility: All work under this section to be provided by the **Electrical Contractor**.
 2. Applicability: This section applies to all renovation and new construction work areas for this Project.
 3. Electrical Contractor shall make arrangements with utility company for temporary and permanent services immediately after award of contract.
 4. Temporary or permanent services for temporarily or permanently installed building equipment such as sump pumps, boilers, cabinet heating and/ or cooling units and fans shall be furnished, installed, operated and maintained so that the said equipment may be operated for drainage and temporary heat when required and/ or when so ordered by the Architect/ Construction Manager.
 5. Electrical Contractor shall maintain all parts of the electrical system (temporary and permanent) active and in-service at all times throughout the contract duration. All temporary lighting to be controlled by standard switches per code (outside of power panels).
 6. Electrical Contractor shall maintain power during the hours established by Construction Manager.
 7. Temporary Service: Install service and grounding in compliance with the National Electric Code (NFPA 70). Include necessary meters, transformers, overload protected disconnect and main distribution switch gear. Comply with all NECA, NEMA and UL Standards
 8. Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.
 9. Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead. Rise vertically where wiring will be least exposed to damage from construction operations.
 10. Provide metal conduit, tubing or armored cable for protection of temporary power wiring where exposed to possible damage during construction operations. Where permitted by code, wiring of circuits not exceeding 110-120 Volt 20 Amp rating and wiring of lighting circuits may be non-metallic sheathed cable in areas where located overhead and exposed. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide metal enclosures or boxes for wiring devices.
 11. Provide overload-protected disconnect switch as required by code.
 12. For power hand tools and task lighting, provide temporary 4-gang outlets at each floor level, spaced so that a 100-foot extension cord can reach each work area. Provide separate 110-120 Volt, 20 Amp circuit for each 4-gang outlet (4 outlets per circuit).
 13. Maintaining all existing systems, including but not limited to, power, lighting, fire alarm, intercom, security, etc., within the existing building operational at all times for Owner occupancy and construction.
- B. TEMPORARY ELECTRICAL AND TELEPHONE SERVICES
1. Temporary Power Source: At each building / renovation area, use the existing electrical power distribution system for temporary power source.
 2. Owner's Requirements: Do not disrupt the Owner's needs for continuous power at each building.

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3. Electrical Contractor shall provide temporary power and lighting facilities for use of all trades. All temporary light and power shall be in accordance with the required Codes and Safety Standards.
4. Electrical Contractor will include in their base bid: Construction Manager field office connection with: a) power c) Internet connection within 5 days after notification by CM. Lines will be run on raised utility poles above 15' high as necessary.
5. All other contractor trailer use / connection charges for power and telephone to be paid for by the respective contractor.

C. RECEPTACLE REQUIREMENTS

1. General Requirements: Provide temporary receptacle outlets as required Minimum Requirements: Provide a minimum of one quad 120-volt receptacle per 2500 square feet of building floor area, with maximum spacing of 50 feet on center for operation of portable tools and appliances during the construction period.
2. Branch Circuits: All temporary receptacle branch circuits to be rated 20 amps with a maximum of (3) duplex receptacles per circuit. Temporary receptacle branch circuits shall be independent of temporary lighting circuits.

D. LIGHTING REQUIREMENTS

1. General Requirements: Electrical Contractor shall provide both interior and exterior lighting at areas where existing lighting has been removed and at new construction areas, as required to provide adequate illumination for safe and proper construction operations and Project Site security.
2. Minimum Requirements: Provide illumination levels adequate for construction operations and safe traffic conditions. As a minimum provide one 200-watt lamp per 400 square feet of building floor area, with maximum spacing of 20 feet. Any rooms in excess of 500 sf will receive one 400-watt metal halide fixture for each 1000 sf of area. (or LED equivalent)
3. Stairways: Provide one 200-watt lamp per landing at each stairway and covered walkway.
4. Supplemental Lighting: If required, supplemental lighting beyond minimum requirements shall be provided via suitable portable lighting units with cord and plugs, and shall be paid for by the Contractor or Sub- Contractor requiring such additional lighting.
5. Restrictions: Do not use permanent lighting systems for temporary construction lighting purposes.

E. MAXIMUM LOADS

1. General: Lighting and power loads connected to the temporary power distribution system shall be limited to the following maximum individual loads:

a. Load Type	Maximum Size
b. 120 volt, 1-phase	1.5 KVA
c. 208 volt, 1-phase	2.5 KVA
d. 208 volt, 3-phase	5.0
2. General: The temporary power distribution system shall be sufficiently sized to provide temporary power as required within this section. Meter and Meter connections to be part of electrical contractors' base bid.

F. SEPARATE POWER NEEDS /ELECTRICAL WELDERS

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1. Separate Power Sources Required: Power for electric welders, abatement panels, etc. and for other loads larger than the maximum allowable sizes shall be taken from portable power sources provided, paid for and operated by the Contractor or Sub-Contractor requiring the use of such equipment. Remove such power sources when no longer needed.

G. ELECTRICAL ENERGY COSTS

1. Paid By Owner: Charges for electrical energy usage for temporary power and lighting will be paid by the Owner, when taken from the Owner's electrical services. Contractor and Sub-Contractors shall exercise measures to conserve energy usage. Use of owner electric for items not specific to project (e.g. heating construction shanties, etc.) will not be permitted

3.5 TEMPORARY TOILET FACILITIES

- A. Sanitary Facilities: Sanitary facilities include temporary toilets/wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project's needs. Existing facilities should not be used.
- B. Responsibilities: The **General Contractor** is responsible for temporary toilet and handwash facilities and their maintenance, cleaning and supplies for use by all trades. Sufficient quantity/locations to properly handle the amount of workers onsite.
- C. Supply and maintain toilet tissue, paper towels, soap/sanitizer and other disposable materials as appropriate for each facility, including Owner's Representative's temporary offices for full contract duration. Provide covered waste containers for used material. Contractor will sanitize the facilities daily.
- D. Provide separate toilet facilities for male and female construction personnel.
- E. Provide separate toilet with handwash facilities for Construction Manager personnel located at Construction Managers trailer

3.6 Not Used

3.7 TEMPORARY WATER

- A. The General Contractor shall:
 1. Provide and maintain a temporary water system of size and capacity as required below to supply the needs of all Contractors for the work.
 2. Provide no less than two 3/4-inch hose bibs conveniently located at each building.
 3. Provide and pay for all connections and permits.
 4. Protect temporary and permanent lines against any damage.
 5. Water source is only available from building. If contractor decides distance is too far he should use water storage tanks or truck at no additional charge to the owner.
- B. Each Contractor shall:

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1. Provide all hose and other extensions from connections installed by the Plumbing Contractor and all labor, materials and supplies required to supply water to the work.
2. Prevent water damage to the work.

3.8 STORAGE FACILITIES

- A. Each Contractor shall provide temporary storage containers, gang boxes and other facilities as required for their own use. Temporary structures shall be located at the staging area per Construction Manager's direction. Temporary items shall be removed upon completion of the work or when directed. All stored materials must be stored in locked, watertight trailers, **paid for by applicable contractor.**
- B. Materials delivered to the site shall be safely stored and adequately protected against loss or damage in watertight, lockable, Conex boxes. Particular care shall be taken to protect and cover materials that are liable to be damaged by the elements.

3.9 SCAFFOLDING AND STAGING

- A. All scaffold, staging and appurtenances thereto shall comply in total to the requirements of Safety and Health Regulations for Construction Chapter XVII of OSHA, Part 1926 and all related amendments.

3.10 RUBBISH CONTAINER

- A. Each Contractor shall provide suitable rubbish container device(s) for his own use (both demolition and construction debris), properly maintained and serviced; replace as required and protected from access by the public fencing as may be specified herein or approved by the Architect or Construction Manager.
- B. Contractors and Subcontractors shall sweep up and gather together daily all his own rubbish and removed materials and place same in containers.

3.11 CONSTRUCTION FENCING

- A. Construction fencing and barriers shall be provided by the **General Contractor**, enclosing all work and storage areas as outlined in staging plans at the end of this section and specified below. Temporary construction fencing shall be of good quality and neat in appearance; 6' high chain link fencing, 9 ga fabric on stanchions with sandbags. (Post driven installation where approved by CM). Open-Mesh Chain Link Fencing: Provide 0.120-inch-thick, galvanized steel posts, and 2.875" dia. Gate posts. Provide 12' lockable gates. (Keys to owner, architect and CM)
- B. Site access gates shall be provided as required, complete with all operating hardware and security devices.
- C. Should fencing be required to be relocated or modified during the course of the project due to additional access needed by the contractor, same shall be done at the total expense of the contractor.

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- D. **General Contractor** to include in his base bid 50' x 50' square enclosed area of temporary fence on stanchions (as described above) with 2 sets 12' wide gates to be installed in any configuration/location as directed by Construction Manager. (Staging area must be restored to it's original condition at the conclusion of the project)

3.12 JANITORIAL SERVICE/DAILY CLEANUP

- A. Each Contractor shall furnish daily cleaning services for the project and perform any required maintenance of facilities as deemed necessary by the Architect and Construction Manager during the entire life of the contract. If any contractor fails to keep the site safe and clean within 4 hours of being notified by CM, either verbally or in writing, the construction manager will have the cleanup work performed by others and the contractors will be back charged accordingly.
1. In addition to the above, the **General Contractor** shall provide a daily sweep and a weekly damp mop of all work areas.

3.13 BURNING

- A. Burning will not be permitted.

3.14 FIRE PREVENTION CONTROL

- A. Each Contractor shall comply with the safety provisions of the National Fire Protection Association's "National Fire Codes" pertaining to the work and, particularly, in connection with any cutting or welding performed as part of the work.

3.15 TEMPORARY FIRE PROTECTION

- A. Each Contractor shall take all possible precautions for the prevention of fires.
1. Where flame cutting torches, blow torches, or welding tools are required to be used, their use shall be as approved by the Construction Manager at the site.
2. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.
- B. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.
- C. No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Owner and/or Architect and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Owner, who shall determine the extent of volatile liquid allowed within the building at any given time.
- D. Each Contractor shall comply with the following requirements relating to compressed gas:
1. Where compressed gas of any type is used for any purpose at the site, it shall be contained in cylinders complying with ICC regulations. Gases of different types shall not be stored together except when in use and when such proximity is required.

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2. All persons required to handle gas cylinders or to act as temporary firemen (Fire Watchers) shall be able to read, write and understand the English language; they shall also be required by the Contractor to read Part 3 of Pamphlet P-1 "Safe Handling of Compressed Gases" published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.

E. Each Contractor shall comply with the following requirements relating to welding and cutting:

1. All cutting and/or welding (electric or gas) must be done only by skilled, certified and licensed personnel.
2. During welding or cutting operations, a contractor's man shall act as a fire watcher. The fire watcher shall have proper eye protection and suitable firefighting equipment including fire extinguisher (bearing current inspection Certificate), protective gloves and any other equipment deemed necessary.
3. Tanks supplying gases for welding or cutting are to be placed in an upright position securely fastened, and close as practical to the operation. Tanks, actives or spares, shall be protected from excess heat and shall not be placed in stairways, hallways or exits. When not in use, protective valve cap shall be screwed on the cylinder.
4. Adequate fire extinguishing equipment shall be maintained at all welding or cutting operations.

3.16 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION:

A. **General Contractor** will provide temporary ventilation as required for protecting the building from any adverse effects of high humidity during abatement and construction activities. Select dehumidification and ventilating equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements and have sufficient quantity of units to produce necessary ambient conditions.

1. Each Contractor shall be responsible for his own temporary ventilation as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
2. Ventilate enclosed area to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.
3. Provide equipment as necessary for air and fresh exchange for the work area per OSHA standards.
4. **Interior Environmental Protection / Plan** - The construction work will be taking place next to occupied areas, thus the General Contractor will provide and maintain a strict negative air environment with machines of sufficient size/qty to properly ventilate the square footage of the work areas. Any dust/fumes must be exhausted through a flexible hose using a temporary up-blast fan to above roof to completely eliminate any vapors/odors/dust. This includes properly sealing windows, doors and openings to create a negative air environment. During the FRP reinforcement system installations, workers must use protective equipment including respirators. The contractors protection plan will be submitted in advance and include a detailed sketch of the program and a narrative explaining sequencing and procedures to insure no infiltration to other areas
5. Any contractor whom allows water infiltration to building is responsible for cleanup and commercial dehumidifiers of sufficient size/qty to prevent mold growth. Failure to immediately address (4 hours notice) will result in the owners hiring others and backcharging in order to insure a safe environment.

3.17 TEMPORARY ROADS AND PERMANENT PAVED AREAS:

A. **General Contractor** shall maintain the temporary access road and staging area adequate to support loads and to withstand exposure to traffic during construction period.

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1. Temporary roads/ staging areas to be constructed by General Contractor. (with approved subbase material. Contractor will maintain and field dress with additional material as necessary to prevent ruts and potholes. This GC contractor to include in their base bid removal of staging area/road gravel and fabric and turf restoration with import material and seeding/mulch.
2. Includes access for delivery through staging area to building work areas, and to equipment and storage areas and sheds.
3. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
4. Road Cleaning: Maintain roads and walkways in an acceptably clean condition. This includes the removal of debris daily, if required, and/or a minimum of once a week due to all project traffic. Road cleaning equipment to be wet/vacuum type. The General Contractor will clean roads for debris from building-related activities.

3.18 DE-WATERING FACILITIES AND DRAINS

- A. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
- B. Remove snow and ice as required to minimize accumulations.

3.19 ROOF PROTECTIONS

- A. All Contractors shall provide temporary protection on the roof surface when it is necessary for work to take place on completed sections. (Minimum 2” polyiso insulation and plywood)
- B. Upon such notification as required in subparagraph A, the Contractor shall assume responsibility for damages, if any, to the roofing system caused by the work of other trades, except that financial liability for any and all damages rests with the offending trade.

3.20 TEMPORARY SITE SAFETY AND DIRECTIONAL SIGNS

- A. The **General Contractor** shall provide signs as required below. Install signs where required or indicated to inform public and persons seeking entrance to project. All signage and posts become the property of the owner at the conclusion of the project.
- B. Construct signs in accordance with section 619 of the NYS DOT standard specifications (MUTCO overall sign size, letter size, metal signage). Support on breakaway metal posts or attach to fencing; do not attach signs to buildings or permanent construction.
- C. Include relocating temporary site safety and directional signs as many times as required or directed.
- D. To direct visitors (4 required)
- E. For construction parking (2 required)
- F. To direct deliveries (2 required)

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- G. Emergency egress only – Construction area (4 required)
- H. Per OSHA standards as necessary
- I. For “No Smoking” safe work site at multiple locations (6 required)
- J. Construction Area – Do Not Enter (10) mount on fence
- K. No Trespassing (10) mount on fence
- L. A premobilization meeting to establish location and quantities of all signage will be held with contractor, Construction Manager, and owner. Prior to the start of any actual work the signage must be reviewed / approved by the Construction Manager.

3.21 NOT USED

3.22 BARRICADES, WARNING SIGNS AND LIGHTS:

- A. Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard.
 - 1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-(16-mm-) thick exterior plywood.

3.23 TEMPORARY ENCLOSURES

- A. General Contractor will provide temporary watertight enclosures for protection of construction, from exposure, foul weather and safety for any roof related openings. Close openings in roof deck with load bearing wood framed construction, 3/4” plywood and watertight membrane
- B. General Contractor will provide temporary 2”x 4” wood framing, 1/2” plywood, and cover with 6 mil reinforced plastic sheathing; at any open exterior window door, openings locations, etc. for weather and security protection at the end of each workday.
- C. Any other temporary enclosures for specific openings for a contractor to perform their work are the responsibility of the contractor creating the opening and shall be installed to protect the building from exterior elements, security issues, odors / noise resulting from construction.

3.24 TEMPORARY PARTITIONS and FLOOR PROTECTIONS

- A. **General Contractor** shall erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate work areas from fumes.
 - 1. Construct dustproof, floor to ceiling partitions of not less than 3-5/8” – 20 ga. studs, 2 layers of 6 mil poly sheets inside / outside, 5/8” plywood, interior sheathing 5/8” gypsum taped/painted where owner occupied. Caulk seal joints and perimeter to prevent dust migrations. Equip partitions with dustproof doors and security locks.
 - 2. In addition to any temporary partition locations shown on drawings, General Contractor will include in his base bid 4 ea. 9’ x12’ temporary partitions meeting the above criteria for use where directed.

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3. Temporary Floor Protections – Shall be “Ram-Board” **Heavy Duty** with taped joints or equivalent. Finish Flooring (new or existing) will be fully covered by GC. Areas of isolated MEP work will be protected with Ram- Board by the individual prime contractor

3.25 AREAS OF SPECIAL PROTECTION:

- A. In the event of an emergency (designated by the sounding of the fire alarm system) all construction activities must immediately cease. Contractor’s work force will evacuate themselves from work areas and remain outside of work areas until the “all clear” is given. No work operations will be tolerated during the evacuation of the building or during an emergency

3.26 ENVIRONMENTAL PROTECTION:

- A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.27 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Termination and Removal: Unless the Architect/ CM requests that it be maintained longer, remove each temporary facility when the need has ended or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been affected because of interference with the 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 the Contractors property.
 2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including.

END OF SECTION



Loading dock and elevator must remain accessible for district deliveries at all times

Fenced Contractor Area

Stair Tower

Scaffold Locations

Ossining High School

Ossining High School Election Parking

50x50 Contractor Staging Area:
6" compacted DOT Item4 over stabilization fabric.
Remove Item 4 / fabric and restore turf at project completion.
Fence by Owner.

Contractors to note traffic pattern for moving materials from staging area to construction area.
Exiting staging area on to Emwilton, to Wolden, to school entrance drive.
Exiting construction area through parking lot to staging area.
Blackout times are as stated in section 011000.

STAGING PLAN

Emwilton Pl

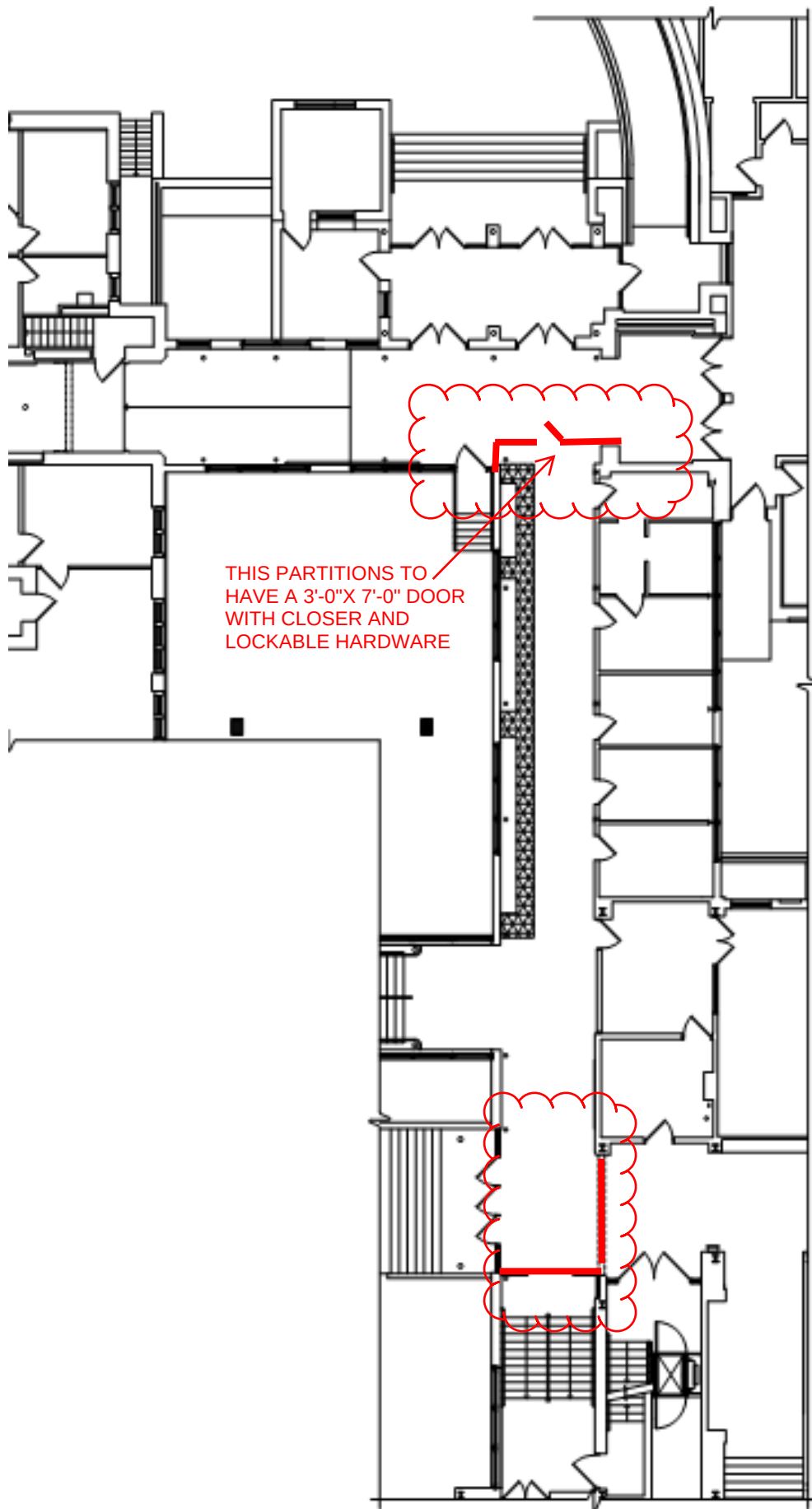
Emwilton Pl

Google

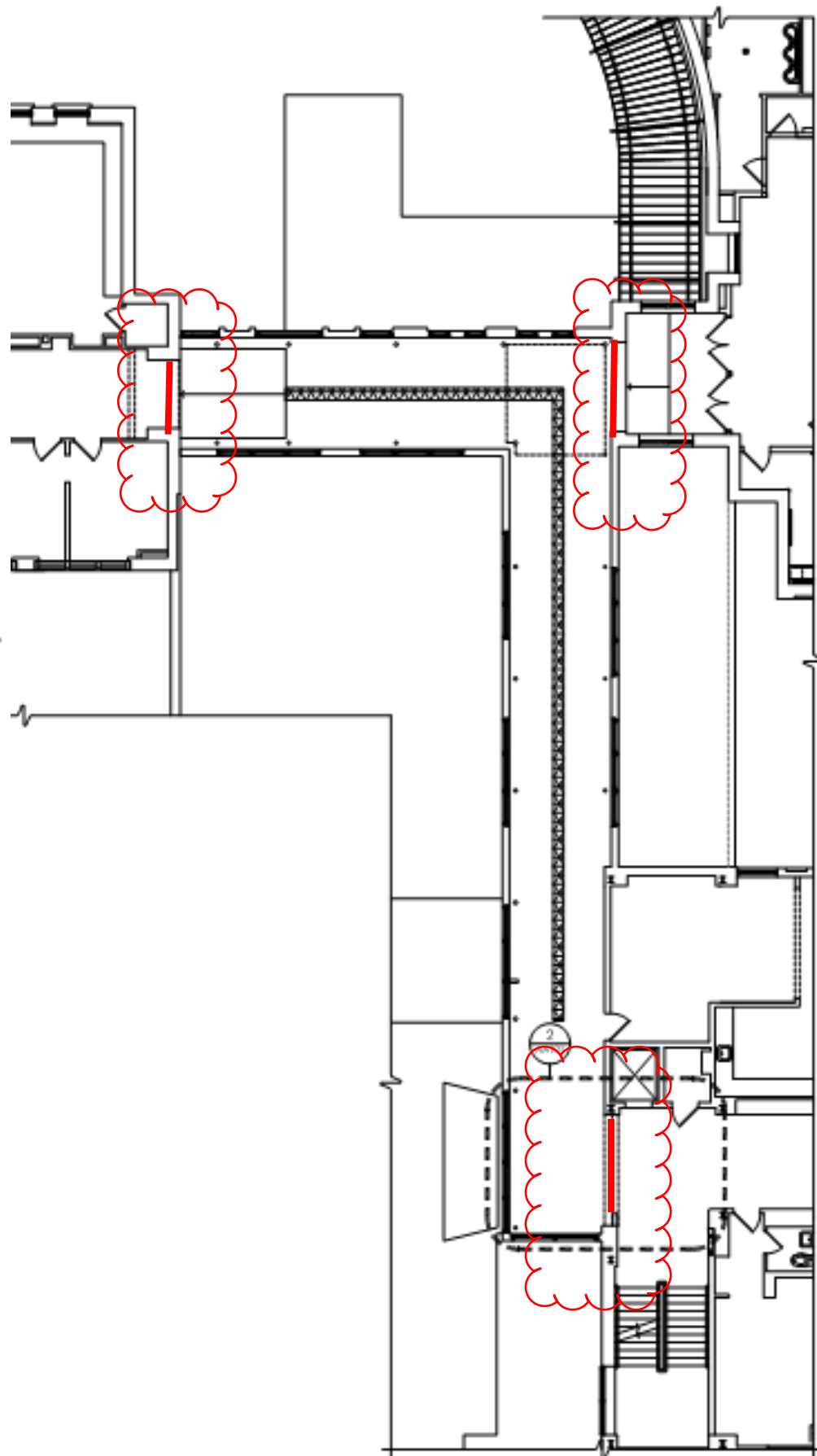
Emwilton Pl

Emwilton Pl

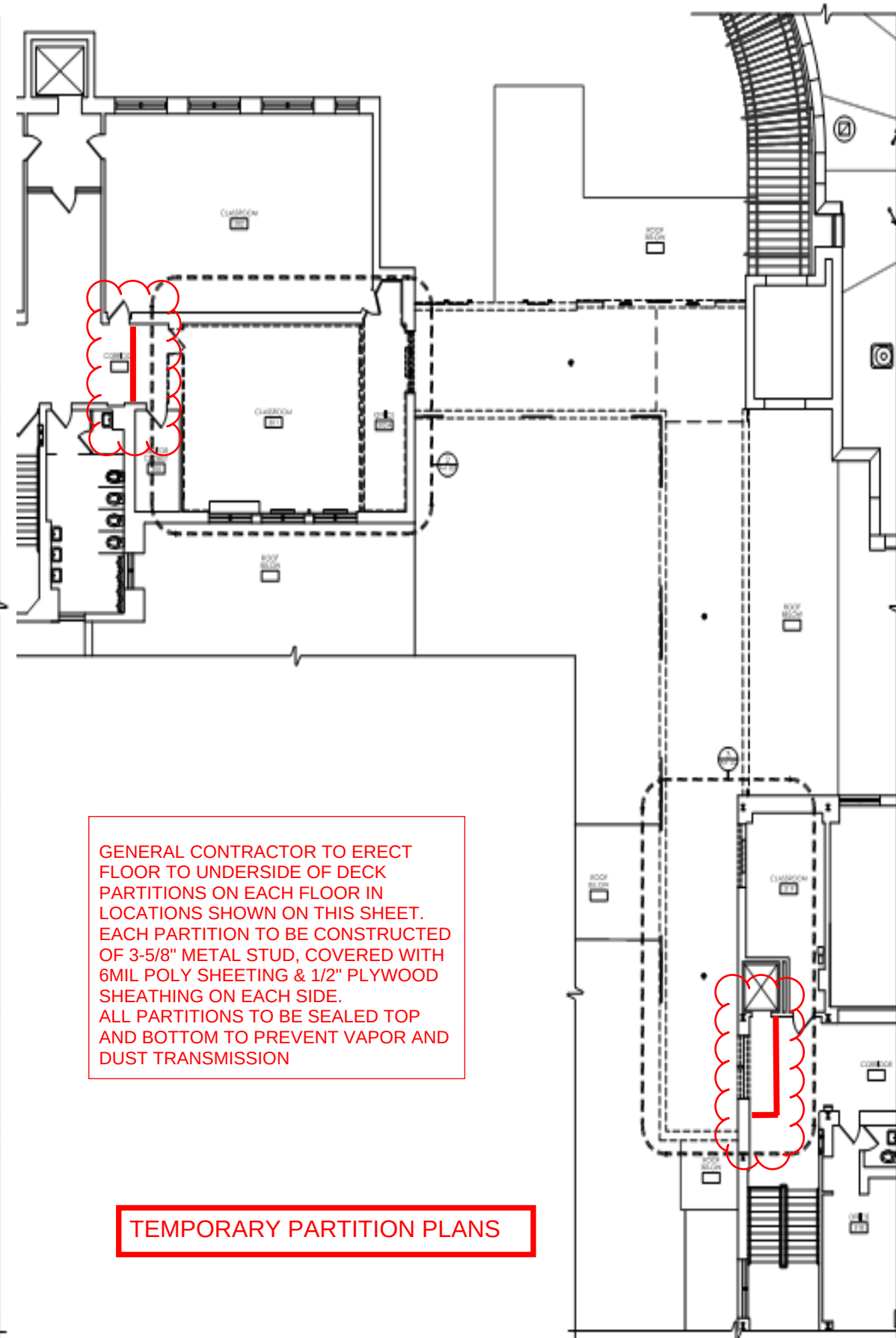
Wolden Rd



1 FIRST FLOOR ASBESTOS ABATEMENT PLAN
SCALE: 1/8" = 1'-0"



1 SECOND FLOOR ASBESTOS ABATEMENT PLAN
SCALE: 1/8" = 1'-0"



TEMPORARY PARTITION PLANS

1 THIRD FLOOR - ROOF - FACADE ASBESTOS ABATEMENT PLAN
SCALE: 1/8" = 1'-0"

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and equivalent products.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 3. Equivalent Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
1. Substitutions requested during the bidding period and accepted by Addendum prior to award of the Contract.
 2. Specified options for products and construction methods included in the Contract Documents.
 3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating equivalent products of other named manufacturers.
- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Special Warranty: Written warranty required by or incorporated into the Contract Documents to extend time limit provided, either by manufacturer's warranty or to provide more rights for Owner.

1.3 SUBMITTALS

- A. Submittals shall comply with the requirements of the Construction Contract Clauses, Division 1 section "SUBMITTAL PROCEDURES" and the individual sections specifying the work.

- B. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Initial Submittal: Within 15 workdays after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 4. Completed List: Within 30 workdays after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 5. Architect's Action: Architect will respond in writing to Contractor within 10 workdays of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- C. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use form provided in Specification Section entitled "PROJECT FORMS AND RELATED DOCUMENTS".
 2. Submit 3 copies of each request for substitution.
 3. Identify the product or the fabrication or installation method to be replaced in each request. Include related specification section and Drawing numbers.
 4. Provide complete documentation including but not limited to the following information, as appropriate:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by others that will be necessary to accommodate the proposed substitution.
 - c. A detailed comparison of the significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include performance, weight, size, durability and visual effect.
 - d. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - e. Product data and drawings, including descriptions of products and fabrication and installation procedures.
 - f. Samples, where applicable or requested.

- g. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - h. Cost information, including a proposal of the net change, if any, in the Contract price.
 - i. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - j. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 5. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 workdays of receipt of request, or 5 workdays of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect can not make a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source. Equipment of the same function shall be manufactured by the same entity, unless otherwise indicated.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Labels and nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on surfaces of products that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate nameplate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information:
 - a. Name of product manufacturer.
 - b. Model and serial numbers.
 - c. Operating data such as capacity, speed and ratings.
 - 3. Protection: Labels and nameplates shall be protected from defacement and other damage during the remainder of the Work.

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. Comply with manufacturer's written instructions.
 - 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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 - 5. Store products to allow for inspection and measurement of quantity or counting of units.
 - 6. Store materials in a manner that will not endanger Project structure.
 - 7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 9. Protect stored products from damage.
- B. Storage: 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 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
 - 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Equalivant: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Equalivant Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Procedures for product selection include the following:
1. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Equalivant Products" Article to obtain approval for use of an unnamed product.
 2. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Equalivant Products" Article to obtain approval for use of an unnamed product.
 3. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a equalivant product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Equalivant Products" Article to obtain approval for use of an unnamed product.
 4. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
 5. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 6. Descriptive Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 7. Performance Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.

8. Prescriptive Requirements: Where Specifications require products that are produced using specified ingredients and components, including specific requirements for mixing, fabricating, curing, finishing, testing and similar operations in the manufacturing process, provide products produced in accordance with the prescriptive requirements that otherwise comply with Contract requirements.
9. Codes, Standards and Regulations: Where Specifications require compliance with an imposed code, standard or regulation, select a product that complies with the codes, standards or regulations specified.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. The request is timely, fully documented, and properly submitted.
 5. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 6. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that, the substitution will overcome the incompatibility.
 7. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
 8. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
 9. Requested substitution has received necessary approvals of authorities having jurisdiction.
 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 EQUALIVANT PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
 2. Field engineering and surveying.
 3. General installation of products.
 4. Coordination of Owner-installed products.
 5. Progress cleaning.
 6. Starting and adjusting.
 7. Protection of installed construction.
 8. Correction of the Work.

1.2 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.

1.3 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 Used)

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: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect and Owner not less than five days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's & Owner's written permission.
- C. 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.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. 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. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two 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.
- D. 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 sitework.
- E. 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 10 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 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 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 regs.
- 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.

3.8 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 equip. for oper.

- 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."

3.9 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.

3.10 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 01 7300

SECTION 01 7310 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work, including, but not limited to; cutting, drilling, chopping, and other similar operations.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation or removal of other Work, including, but not limited to; patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, and other similar operations to match adjoining surfaces.

1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal 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 Existing 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. Construction Manager's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 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. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Foundation construction
 - b. Bearing and retaining walls
 - c. Structural concrete
 - d. Structural steel
 - e. Lintels
 - f. Timber and primary wood framing
 - g. Structural decking
 - h. Stair systems
 - i. Miscellaneous structural metals

- j. Exterior curtain-wall construction
 - k. Equipment supports
 - l. Piping, ductwork, vessels, and equipment
 - m. Structural systems of special construction in Division 13 Sections.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment
 - b. Air or smoke barriers
 - c. Water, moisture, or vapor barriers
 - d. Membranes and flashings
 - e. Fire protection systems
 - f. Noise and vibration control elements and systems
 - g. Control systems
 - h. Communication systems
 - i. Conveying systems
 - j. Electrical wiring systems
 - k. Operating systems of special construction in Division 13 Sections
- C. 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.
 - 1. If possible, retain the original install or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.
 - a. Firestopping
 - b. Acoustical ceilings
 - c. Acoustical panels
 - d. Finished wood flooring
 - e. Synthetic sports flooring
 - f. Carpeting
 - g. HVAC enclosures, cabinets, or covers
 - h. Ceramic and quarry tile
 - i. Gypsum board
 - j. Masonry (exterior and interior where exposed)
 - k. Tack boards
 - l. Casework
 - m. Finish carpentry
- D. 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.

1.5 WARRANTY

- A. Existing 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 existing warranties.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing 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 existing 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 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 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 existing 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 existing 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. Existing 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 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. 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 weathertight condition.

END OF SECTION 01 7310

SECTION 01 74 23 - CLEANING UP

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK:

A. The work of this section relates to the following:

1. Maintain all premises and public properties/roadways free from accumulations of waste, debris, dirt, mud and rubbish caused by operations on a daily basis.
2. At completion of work, remove waste materials, rubbish tools, equipment, machinery and surplus materials, and clean all sight exposed surfaces; leave project clean and ready for occupancy.
3. Remove all overspray caused by construction operations from adjacent construction, surfaces and vehicles.

B. Related Requirements Specified Elsewhere

1. Summary of work: Section 011000
2. Cleaning for Specific Products or Work: the respective sections of the specifications:

1.2 SAFETY REQUIREMENTS

A. Standards: Maintain project in accord with safety and insurance standards.

B. Hazard Control/Cleaning Products

1. Store volatile waste in covered metal containers and remove from premises daily.
2. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile waste such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of waste into streams or waterways.

PRODUCTS

Materials: Use only cleaning materials recommended by manufacturer of surface to be cleaned.

PART 2 - EXECUTION

2.1 REQUIREMENTS DURING CONSTRUCTION:

- A. Execute daily cleaning to ensure that building, grounds, and public properties and roadways are maintained free from accumulations of waste materials, rubbish, dirt, mud and dust.

- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- C. Each day, all contractors shall adhere to the following:
 - 1. Areas of intense activity, such as cutting and sawing must be swept clean and reorganized at the end of each day. Utilize dust control methods such as plastic containment, containment hut and/or wetting of surfaces.
 - 2. Areas of moderate activity such as installation of plumbing, ductwork, electrical work must be returned to good order at the end of each day.
 - 3. Debris below scaffolds (and shoring/re-shoring) must at all time, be kept sufficiently consolidated to keep walkways free of tripping hazards. These work areas must also be swept clean immediately upon removal of scaffolds.
 - 4. All swept up debris, waste materials, and packing must be removed and placed in the dumpster by the end of the workday.
 - 5. All stored material must be protected and kept in good order.
 - 6. As portions of the work are completed, all used and excess materials must be removed promptly.
 - 7. Daily Clean-up and good housekeeping is the responsibility of each contractor individually and will be monitored by the Construction Manager. If any contractor fails to perform cleaning when directed or does not properly clean within 4 hours of being notified by Construction Manager, the owner will hire others and charge contractor(s) accordingly.
 - 8. Contractors shall promptly comply with requests to organize scattered materials.
- D. **Each Contractor** is responsible for furnishing all dumpsters or other such containers as required for collection, storage and legal disposal of all debris and rubbish resultant from their construction operations. The Construction Manager shall locate and request to move such containers as necessary and legally dispose of waste as containers are filled. Separate and recycle as required authorities and regulations.
- E. Vacuum clean areas when ready to receive finish painting, and continue vacuum cleaning on an as needed basis until building is ready for Substantial Completion or occupancy.
- F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- G. Schedule cleaning operations so that dust and other containment resulting from cleaning process will not fall on wet, newly painted surfaces.

2.2 FINAL CLEANING

- A. Each Contractor Shall:
 - 1. Employ professional cleaners for final cleaning.
 - 2. In preparation for substantial completion or occupancy, conduct final inspection of sight exposed interior and exterior surfaces, and of concealed spaces.

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3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surface so designated to shine finish.
 4. Maintain cleaning until project, or portion thereof, is occupied by owner.
 5. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.
 6. If the contractor fails to perform final cleaning when directed or does not properly clean within 4 hours of being notified by Construction Manager, the owner will hire others and charge contractor accordingly.
- B. **General Contractor**: shall complete the following restoration operations before requesting inspection for certification of Substantial Completion for entire Project or portion of Project:
1. Restoration of any lawn and walk/curb areas disturbed by construction operations. This includes repairs of any ruts / damage created by Heavy equipment, Lulls, cranes, etc.
 2. Magnet sweeping of all exterior lawn areas to ensure that no stray nails / screws, etc. remain in lawn areas.
 3. Hire professional cleaning company (not construction tradesmen) to thoroughly clean all surfaces, including glass, floorsing, ceramic tile, doors, windows, etc.
 4. Wax resilient tile, linoleum, terrazzo floors using the exact same products / coats as the owner's custodial staff for compatibility purposes. Vacuum all carpet areas
 5. Power sweep all asphalt areas using a commercial street sweeper (water method)
 6. Remove any stickers, protective coverings, etc.
- C. **Electrical Contractor**: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.
1. Clean surfaces of all electrical equipment from any dust. Remove any labels or protective films
 2. Replace any burned out or non-functioning bulbs
- D. **Mechanical Contractor**: shall complete the following cleaning operations before requesting final inspection for certification of Substantial Completion for entire project or portion of project.
1. Clean all Mechanical units, including removal of any stickers, protective covering. Wipe down of all unit surfaces for clean streak free surfaces
 2. Vacuum out all ductwork, grills/louvers to insure there is no construction debris or dust
 3. Replace all air filters at no additional cost immediately prior to owner occupancy

2.3 RUBBISH REMOVAL

- A. Contractors shall comply with all Local, State and Federal Laws, Codes and Requirements regarding recycling and trash or rubbish removal.

END OF SECTION

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- 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. Operation and maintenance manuals.
 4. Warranties.
 5. Instruction of Owner's personnel.
 6. Final cleaning.

1.2 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. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, 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, 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 and Construction Manager 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.

1.3 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 according to Division 1 Section entitled "PAYMENT PROCEDURES."
 - a. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 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 final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit pest-control final inspection report and warranty.
 7. 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 and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 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 and Construction Manager'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. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the owner's Sample storage area.
- F. 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.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
 1. Operation Data:
 - a. Emergency instructions and procedures.
 - b. System, subsystem, and equipment descriptions, including operating standards.
 - c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.

- d. Description of controls and sequence of operations.
 - e. Piping diagrams.
 - 2. Maintenance Data:
 - a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures.
 - d. Maintenance and service schedules for preventive and routine maintenance.
 - e. Maintenance record forms.
 - f. Sources of spare parts and maintenance materials.
 - g. Copies of maintenance service agreements.
 - h. Copies of warranties and bonds.
- B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.6 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-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 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, through Construction Manager, 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. 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 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
1. Operation and maintenance documentation directory.
 2. Emergency manuals.
 3. Operation manuals for systems, subsystems, and equipment.
 4. Maintenance manuals for the care and maintenance of systems and equipment.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.4 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

- b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions.
 - 2. Performance and design criteria if Contractor is delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.

6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation manuals.
 - 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- G. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
1. Record Drawings.
 2. Record Specifications.
 3. Record Product Data.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
1. Number of Copies: Submit one set of marked-up Record Prints.
 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one set of plots from corrected Record CAD Drawings and one set of marked-up Record Prints. Architect will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return plots and prints for organizing into sets, printing, binding, and final submittal.
 - b. Final Submittal: Submit one set of marked-up Record Prints, one set of Record CAD Drawing files, one set of Record CAD Drawing plots, and three copies printed from record plots. Plot and print each Drawing, whether or not changes and additional information were recorded.
 - 1) Electronic Media: CD-ROM.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.

- d. Locations and depths of underground utilities.
- e. Revisions to routing of piping and conduits.
- f. Revisions to electrical circuitry.
- g. Actual equipment locations.
- h. Duct size and routing.
- i. Locations of concealed internal utilities.
- j. Changes made by Change Order or Construction Change Directive.
- k. Changes made following Architect's written orders.
- l. Details not on the original Contract Drawings.
- m. Field records for variable and concealed conditions.
- n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
 1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to Architect for resolution.
 3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
 4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.
- C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
 1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
 2. Format: DWG, Version Autocad 2000, operating in Windows XP operating system.
 3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect for resolution.
 5. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
 - a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
 - b. CAD Software Program: The Contract Drawings are available in Autocad 2000, operating in Windows XP operating system.
- D. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

2. Consult with Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- E. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
 3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Drawings, and Product Data where applicable.

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, Record Drawings, and Product Data where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
1. Demonstration of operation of systems, subsystems, and equipment.
 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including 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. At completion of training, submit one complete training manual for Owner's use.
- B. 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.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
- E. Demonstration and Training Videotape: Submit two copies at end of each training module.

1.3 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 Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

- 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 has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. 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, and as follows:
 - 1. Motorized doors, including, overhead coiling doors, overhead coiling grilles and automatic entrance doors.
 - 2. Equipment, including stage equipment, projection screens, loading dock equipment, waste compactors, food-service equipment, residential appliances and laboratory fume hoods.
 - 3. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
 - 4. Intrusion detection systems.
 - 5. Conveying systems, including elevators, wheelchair lifts and cranes.
 - 6. Gas equipment, including medical gas equipment and piping.
 - 7. Laboratory equipment, including laboratory air and vacuum equipment and piping.
 - 8. Heat generation, including, boilers, feedwater equipment, pumps, steam distribution piping and water distribution piping.
 - 9. Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
 - 10. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
 - 11. HVAC instrumentation and controls.
 - 12. Electrical service and distribution, including transformers, switchboards panelboards, uninterruptible power supplies and motor controls.
 - 13. Packaged engine generators, including transfer switches.
 - 14. Lighting equipment and controls.
 - 15. Communication systems, including intercommunication, surveillance, clocks, programming voice and data and television equipment.
 - 16. Any other equipment not specifically listed that is part of these construction documents.
- 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:
 - 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. Operations manuals.

- c. Maintenance manuals.
- d. Project Record Documents.
- e. Identification systems.
- f. Warranties and bonds.
- g. 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 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.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- 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 Architect, with at least seven days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Demonstration and Training Videotape: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. Comply with requirements in Division 1 Section "Photographic Documentation."
 - 2. At beginning of each training module, record each chart containing learning objective and lesson outline.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 7900

SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

PART I – GENERAL

1.01 DESCRIPTION

- A. All work under this contract shall be performed in strict accordance with the specifications and all applicable laws for asbestos removal projects. The Abatement Contractor shall furnish all labor, materials, supervision, services, insurance and equipment necessary for the complete and total removal of Asbestos-containing Materials (ACM) as described herein, in attachments to the specification, Job Specific Variance(s) and/or as directed by Ossining UFSD (here-in-after the "Owner") and/or the Owners Representative(s) to support the ***Ossining UFSD – Ossining HS 3rd Floor Connector Addition.***
- B. Abatement Contractor shall provide for personnel air monitoring to satisfy OSHA regulation 29 CFR Parts 1926.1101(f). All work performed shall be in strict accordance with applicable provisions and regulations promulgated under New York State Department of Labor, Industrial Code 56 (ICR-56).
- C. The Abatement Contractor shall satisfy the requirements for asbestos projects issued by the New York State Department of Labor concerning licensing and certification; notification; equipment; removal and disposal procedures; engineering controls; work area preparation; decontamination and clean-up procedures; and personnel air monitoring.
- D. The Abatement Contractor shall be responsible for submittal of asbestos project notification(s) and applicable fees to EPA and NYSDOL concerning this project. Project notification(s) shall be made for the cumulative total of ACM to be removed as required by ICR-56-3.4. Work practices for each individual work area established shall be consistent with the quantity of ACM contained within that work area as defined in ICR-56-2.
- E. The scope of work under this contract shall include the following:
 - 1. All asbestos-containing materials (ACM) shall be removed in accordance with these specifications. The Abatement Contractor is responsible for field verification of estimated quantities, locations and other site conditions that may affect work.
 - 2. All fixed objects remaining within the work area(s) shall be protected as required by Title 12 NYCRR Section 56-7.10(b) and as described in these specifications.
 - 3. The containerization, labeling and disposal of all asbestos waste in accordance with applicable city, state and federal regulations and these specifications.
 - 4. The Abatement Contractor will be responsible for repairing all building components damaged during abatement including, but not limited to, ceiling tiles, ceiling finishes, wall finishes and/or floor finishes, etc.
 - 5. The Abatement Contractor shall be responsible for any and all demolition required to access materials identified in scope of work and on associated drawings.

6. Concealed conditions that are exposed and may require additional work shall be brought to the attention of the Owner(s) immediately. The Abatement Contractor shall not abate these areas without a written notice to proceed. If the Abatement Contractor removes additional asbestos prior to the order to proceed the additional work will not be acknowledged.
7. Permissible working hours shall be Monday through Friday 7:00 A.M. to 4:00 P.M. and/or as defined by the Owner(s) and/or Owner's Representative(s). Holidays shall be considered weekends and not included for working days. Upon written approval from the Owner, the Abatement Contractor may work past these hours. The Abatement Contractor will incur any and all costs associated for work performed beyond the defined schedule including, but not limited to: abatement activities, project/air monitoring, custodial/staffing labor, overtime, mobilizations, etc.
8. Buildings will be turned over to the Abatement Contractor as is. At that time, all electrical services and HVAC systems in the proposed work areas will be shut down. Electricity and water supply will be maintained in the building for use by the Abatement Contractor. The Abatement Contractor is responsible for securing all power in the work area(s) and establishing all temporary GFCI hookups necessary to complete his work.
9. The Abatement Contractor shall remove all identified Asbestos-containing Materials (ACM) to building substrate(s); in areas indicted. Subsequent to final air clearances, the substrate(s) shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering and eliminate residual odors.
10. The Abatement Contractor must coordinate location of waste containers with the Facility and the Owner. Deliveries and storage of equipment must be coordinated with the Facility and the Owner.
11. All "Large" and "Small" asbestos abatement projects, as defined by 12 NYCRR56 shall not be performed while the building is occupied. The term "building" means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exists that do not pass through the occupied portion(s) and ventilation systems must be physically separated and sealed at the isolation barriers.

1.02 PRE-CONTRACT SUBMITTALS

Within three (3) days after bids are opened, the three (3) apparent low bidders shall be required to submit the following documentation:

A. Resume': Shall include the following:

1. Provide a list of projects of similar nature performed within the past two (2) years and include the dollar value of all projects. Provide project references to include owner, consultant, and air monitoring firms' name, contact person, address, and phone number, include location of project and date of completion.
2. Abatement Contractor license issued by New York State Department of Labor for asbestos work in accordance with ICR-56-3.

3. A list of owned equipment available to be used in the performance of the project.
4. The number of years engaged in asbestos removal.
5. An outline of the worker training courses, and medical surveillance program conducted by the Abatement Contractor.
6. A standard operating procedures manual describing work practices and procedures, equipment, type of decontamination facilities, respirator program, special removal techniques, etc.
7. Documentation to the satisfaction of the Owner pertaining to the Abatement Contractor's financial resources available to perform the project. Such data shall include, but not be limited to, the firm's balance sheet for the last fiscal year.

B. Citations/Violations/Legal Proceedings

1. Submit a notarized statement describing any citations, violations, criminal charges, or legal proceedings undertaken or issued by any law enforcement, regulatory agency, or consultant concerning performance on previous asbestos abatement contracts. Briefly describe the circumstances citing the project and involved persons and agencies as well as the outcome of any actions.
2. Answer the question: "Has your firm or its agents been issued a Stop Work order on any project within the last two years?" If "Yes" provide details as discussed above.
3. Answer the question: "Are you now, or have you been in the past, a party to any litigation or arbitrations arising out of your performance on Asbestos Abatement Contracts?" If "Yes" provide details as discussed in 1. above.
4. Describe any liquidated damages assessed within the last two years.

C. Preliminary Schedule

1. Provide a detailed schedule including work dates, work shift times, estimate of manpower to be utilized and the start and completion date for completion of each major work area.

1.03 DOCUMENTATION

A. The Abatement Contractor shall be required to submit the following and receive the Consultant's approval prior to commencing work on this project:

1. Provide documentation of worker training for each person assigned to the project. Documentation shall include copies of each workers valid New York State asbestos handler certificates (for those employees who may perform asbestos removal), documentation of current respirator fit test and current OSHA required training and medical examination.

2. The attached "Asbestos Employee Medical Examination Statement" and "Asbestos Employee Training Statement" forms shall be completed, signed and submitted for each worker assigned to the project. Records of all employee training and medical surveillance shall be maintained for at least forty (40) years. Copies of the records shall be submitted to the Consultant prior to commencement.
3. The Abatement Contractor shall submit proof of a current, valid license issued by the New York State Department of Labor pursuant to the authority vested in the Commissioner by section 906 of the Labor Laws, and that the employees performing asbestos related work on this project are certified by the State of New York as required in Part 56 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York latest edition. Copies of all licenses shall be submitted prior to the commencement of the project.
4. The Abatement Contractor shall submit a written respiratory protection program meeting the requirements of 29 CFR 1910.134 to the Consultant.
5. The name, address, social security number and NYS DOL certificate number of the person(s) who will supervise the asbestos project.
6. The name and address of the deposit or waste disposal site or sites where the asbestos materials are to be deposited or disposed of. This site must be approved by the Owner. The manifesting procedure must also be specified.
7. The name, address and New York State Dept. of Environmental Conservation ID Number of any transporters that are to be used to transport waste.
8. A written Standard Operation Procedure (SOP) that is designed and implemented to maximize protection against human exposure to asbestos dust. The SOP shall take into consideration the workers, visitors, building employees, general public and environment. As a minimum the procedures must include the following:
 - a. Security for all work areas on an around-the-clock basis against unauthorized access.
 - b. Project organization chart including the phone numbers of at least two responsible persons who shall be authorized to dispatch men and equipment to the project in the event of an emergency; including weekends.
 - c. Description of protective clothing and NIOSH approved respirators to be used.
 - d. Description of all removal methods to be used, including HEPA air filtration and decontamination sequence with special emphasis on any procedure that may deviate from these specifications.
 - e. A list of manufacturers' certificates stating that all vacuums, negative air filtration equipment, respirators and air supply equipment meet OSHA and EPA requirements.
 - f. A list of all materials proposed to be furnished and used under this contract.
 - g. Emergency evacuation procedures in the event of fire, smoke or accidents such as injury from falling, heat exposure, electrical shock, etc.

- h. The name, address and ELAP number of the New York State Department of Health Certified Analytical Testing Laboratory the Contractor proposes to use for the OSHA monitoring.
 9. A detailed plan, in triplicate, for the phasing of the project, division of work areas and location of decontamination facilities, waste containers and temporary office.
 10. Work schedule, identifying firm dates and completion for actual areas. Bar chart or critical path chart indicating phases is required.
- B. The Abatement Contractor shall post their NYS DOL contractor's license and maintain a daily log documenting the dates and time of the following items within each personal decontamination unit:
 1. Meetings; purpose, attendants, discussion (brief)
 2. Sign-in and sign-out of all persons entering the work area including name, date, time, social security number, position or function and general description of daily activity.
 3. Testing of barriers and enclosure systems using smoke tubes prior to the beginning of abatement activities and at least once a day thereafter until satisfactory clearance air monitoring results have been achieved.
 4. Inspection of all plastic barriers, twice daily, by the asbestos supervisor.
 5. Loss of enclosure integrity; special or unusual events, barrier breaches, equipment failures, etc.
 6. Daily cleaning of enclosures.
 7. Personnel air monitoring test results for OSHA Compliance. Results shall be posted at the work site within 24 hours of testing and copies supplied to the Owner within five (5) days of testing. Abnormalities shall be supplied to the Owner immediately.
- C. Documentation with confirmation signature of Consultant's representative of the following shall be provided by the Abatement Contractor at the final closeout of the project.
 1. Testing of barriers and enclosure systems using smoke tubes shall be performed prior to the beginning of abatement activities and at least once a day thereafter until satisfactory clearance air monitoring results have been achieved.
 2. Inspection of all plastic barriers.
 3. Removal of all polyethylene barriers.
 4. Consultant's inspections prior to encapsulation.
 5. Removal of waste materials.
 6. Decontamination of equipment (list items).
 7. Consultant's final inspection/final air tests.

- D. The Abatement Contractor shall provide records of all project information, to include the following which shall be submitted upon completion of the project and prior to approval of the Abatement Contractor's payment application:
1. The location and description of the abatement project.
 2. The name, address and social security number of the person(s) who supervised the asbestos project.
 3. Certified payroll documentation Pursuant to Article 8, Section 220 of the NYS Labor Law
 4. Copies of EPA/NYSDOL Asbestos Certificates for all Workers and Supervisors employed on the Project.
 5. Copies of Medical Approval and Respirator Fit Testing for all Asbestos Workers and Supervisors employed on the Project.
 6. Copies of Abatement Contractors Daily Sign-In Sheets & Logs for persons entering and leaving the work area. – Title 12 NYCRR Part 56-7.3.
 7. Copies of Abatement Contractor's personal air sampling laboratory results.
 8. The amounts and type of asbestos materials that was removed, enclosed, encapsulated, or disturbed.
 9. The name and address of the deposit or waste disposal site or sites where the asbestos waste materials were deposited or disposed of and all related manifests, receipts and other documentation associated with the disposal of asbestos waste.
 10. The name and address of any transporters used to transport waste and all related manifests, receipts and other documentation associated with the transport of asbestos waste.
 11. All other information that may be required by state, federal or local regulations.
 12. Copy of the Supervisor's Daily Project Log of events as described in 1.03 B, above.

1.04 NOTIFICATIONS AND PERMITS

- A. The Abatement Contractor shall be required to prepare and submit notifications to the following agencies at least ten (10) days prior to the commencement of the project:
1. Asbestos NESHAPS Contact
U.S. Environmental Protection Agency
NESHAPS Coordinator, Air Facilities Branch
26 Federal Plaza
New York, New York 10007
(212) 264-7307

2. State of New York Department of Labor
Division of Safety and Health
Asbestos Control Bureau
State Office Building Campus, Building 12, Room 454
Albany, New York 12240
3. Owner(s): Ossining UFSD
400 Executive Boulevard
Ossining, NY 10562
ATTN: Jared Mance, Director of School Facilities, Operations & Maintenance
Ph. (914) 762-5740 Ext. 3366
E-mail. jmance@ossiningufsd.org
4. Environmental Consultant(s): Quality Environmental Solutions & Technologies, Inc. (QuES&T)
1376 Route 9
Wappingers Falls, New York 12590
ATTN: Rudy Lipinski, Director of Field Operations
Ph. (845) 298-6031
Fx. (845) 298-6251
E-mail. rlipinski@qualityenv.com

B. The notification shall include but not be limited to the following information:

1. Name and address of Owner.
2. Name, address and asbestos handling license number of the Abatement Contractor.
3. Address and description of the building, including size, age, and prior use of the building or area; the amount, in square feet or linear feet of asbestos material to be removed; room designation numbers or other local information where asbestos material is found, including the type of asbestos material (friable or non-friable).
4. Scheduled starting and completion dates for removal.
5. Methods to be employed in abating asbestos containing materials.
6. Procedures and equipment, including ventilating/exhaust systems, that will be employed to comply with the Code of Federal Regulation (CFR) Title 40, Part 61 of the U.S. Environmental Protection Agency.
7. The name and address of the carting company and of the waste disposal site where the asbestos waste will be deposited.

NOTE: Notifications shall be submitted using standard forms as may be used by the respective agency.

For DOL (NYS) include "Asbestos Project Notification" form (DOSHS-483) with proper fee, if required. For EPA include "Notification of Demolition and Renovation"; 40 CFR Part 61.

- C. The Abatement Contractor shall secure any permits required by the city, town, county, or state that may be required and the cost for obtaining the permit shall be included in his base bid.
- D. The Abatement Contractor shall erect warning signs around the work space at every point of potential entry into the work area in accordance with OSHA 1926.58k (2), (i). These signs shall bear the following information:

DANGER

CANCER AND LUNG DISEASE HAZARD

**AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE
CLOTHING
ARE REQUIRED IN THIS AREA**

- E. The Abatement Contractor shall post at entrances to the work place and immediate adjacent areas, notifications to building occupants which include the name and license number of the contractor, project location and size, amount and type of ACM, abatement procedures, dates of expected occurrence and name and address of the air monitor and laboratory in compliance with ICR 56-3.6.
- F. The Abatement Contractor shall post a list of emergency telephone numbers at the job site which shall include the Owner's Representative, police, emergency squad, local hospital, Environmental Protection Agency, N.Y. State Department of Labor, Occupational Safety and Health Administration and the local Department of Health.

1.05 APPLICABLE STANDARDS

Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, applicable standards of the construction industry have the same force and effects (and are made a part of contract documents by reference) as if copied directly into contract documents, or as if published copies were bound herewith. Resolution of overlapping and conflicting requirements, which result from the application of several different industry standards to the same unit of work, shall be by adherence to the most stringent requirement.

- A. Applicable standards listed in these Specifications form a part of this Specification and include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:
1. ANSI:
American National Standards Institute
1430 Broadway
New York, New York 10018
 2. ASHRAE:
American Society for Heating, Refrigerating
and Air Conditioning Engineers
1791 Tullie Circle NE
Atlanta, Georgia 30329

3. ASTM:
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pennsylvania 19103
4. CFR
Code of Federal Regulations Available
from Government Printing Office
Washington, District of Columbia 20402
5. CGA
Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202
6. CS
Commercial Standard of NBS
(US Dept. of Commerce)
Government Printing Office
7. EPA
Environmental Protection Agency, Region II
26 Federal Plaza
New York, New York 10007
Asbestos Coordinator - Room 802
(212) 264-9538
Part 61, Sub-Parts A & B
National Emission Standard for Asbestos
8. FEDERAL SPECS
Federal Specification (General Services Administration)
7th and D Street, SW
Washington, District of Columbia 20406
9. NBS
National Bureau of Standards
(US Department of Commerce)
Gaithersburg, Maryland 20234
10. NEC
National Electrical Code (by NFPA)
11. NFPA
National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269
12. NIOSH
National Institute for Occupational Safety and Health
26 Federal Plaza
New York, New York 10007

13. NYSDOH

New York State Department of Health
Bureau of Toxic Substance Assessment
Room 359 - 3rd Floor
Tower Building Empire State Plaza
Albany, New York 12237

14. NYSDEC

New York State Department of Environmental Conservation
Room 136
50 Wolf Road
Albany, New York 12233-3245

15. NYSDOL

State of New York Department of Labor
Division of Safety and Health
Asbestos Control Program
State Campus
Building 12
Albany, New York 12240

16. OSHA

Occupational Safety and Health Administration
(US Department of Labor)
New York Regional Office - room 3445
1515 Broadway
New York, New York 10036

17. UL

Underwriters Laboratories
333 Pfingsten Road
Northbrook, Illinois 60062

B. Federal Regulations: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:

1. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA):

- a. Asbestos Regulations
Title 29, Part 1910, of the Code of Federal Regulations.
- b. Respiratory Protection
Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
- c. Construction Industry
Title 29, Part 1926, of the Code of Federal Regulations.
- d. Access to Employee Exposure & Medical Records
Title 29, Part 1910, Section 20 of the Code of Federal Regulations.

- e. Hazard Communication
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.
- f. Specifications for Accident Prevention Signs and Tags
Title 29, Part 1910, section 145 of the Code of Federal Regulations.
- 2. U.S. Environmental Protection Agency (EPA):
 - a. Asbestos Hazard Emergency Response Act (AHERA) Regulation Asbestos Containing Materials in Schools Final Rule & Notice Title 40, Part 763, Subpart E of the Code of Federal Regulations.
 - b. Worker Protection Rule
40 CFR Part 763, Subpart G, CPTS 62044, FLR 2843-9
Federal Register, Vol. 50, No. 134, 7/12/85, P28530-28540
 - c. Regulation for Asbestos
Title 40, Part 61, Subpart A of the Code of Federal Regulations
 - d. National Emission Standard for Asbestos
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
 - e. Resource Conservation and Recovery Act (RCRA) 1976, 1980
Hazardous and Solid Waste Amendments (HSWA) 1984
Subtitle D, Subtitle C
- 3. U.S. Department of Transportation (DOT):
 - a. Hazardous Substances: Final Rule Regulation 49 CFR, Part 171 and 172.
- C. State Regulations: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:
 - 1. New York State Department of Environmental Conservation (DEC) Regulations regarding waste collection registration. Title 6, Part 364 of the New York State Official Compilation of Codes, Rules and Regulations - 6NYCRR 364.
 - 2. New York State Right-To-Know Law
 - 3. New York State Department of Labor Asbestos Regulations Industrial Code Rule 56.
 - 4. New York State Department of Health, Title 10 Part 73 Asbestos Safety Program Requirements.
- D. Standards: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:
 - 1. American National Standards Institute (ANSI)
 - a. Fundamentals Governing the Design and Operation of Local Exhaust Systems
Publication Z9.2-79

- b. Practices for Respiratory Protection
Publication Z88.2-80

E. Guidance Documents: Those that discuss asbestos abatement work or hauling, and disposal of asbestos waste materials are listed below only for the Abatement Contractor's information. These documents do not describe the work and are not a part of the work of this contract.

EPA:

1. Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)
EPA560/5-85-024.
2. Asbestos Waste Management Guidance EPA 530-SW-85-007.

F. Patents and Royalties: The Abatement Contractor shall pay all royalties and/or license fees. The Abatement Contractor shall defend all suits and claims for infringement of any patent rights and save the Owner and Consultant harmless from loss including attorney fees on account thereof.

1.06 DEFINITIONS

As used in or in connection with these specifications the following are terms and definitions.

Abatement - Procedure to control release from asbestos material. This includes removal, encapsulation and enclosure.

Aggressive sampling - A method of sampling in which the person collecting the air sample creates activity by the use of mechanical equipment during the sampling period to stir up settled dust and simulate activity in that area of the building.

AIHA - The American Industrial Hygiene Association, 475 Wolf Ledges Parkway, Akron, Ohio 44311.

Airlock - A system for permitting entrance and exit while restricting air movement between a containment area and an uncontaminated area. It consists of two curtained doorways separated by a distance of at least three feet such that one passes through one doorway into the airlock, allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway, thereby preventing flow-through contamination.

Air sampling - The process of measuring the content of a known volume of air collected during a specific period of time.

Amended water - Water to which a surfactant has been added.

Approved asbestos safety program - A program approved by the Commissioner of Health providing training in the various disciplines that may be involved in an asbestos project.

Area air sampling - Any form of air sampling or monitoring where the sampling device is placed at some stationary location.

Asbestos - Any naturally occurring hydrated mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cumingtonite-gunerite), crocidolite (riebeckite), tremolite, anthophyllite and actinolite.

Asbestos contract - An oral or written agreement contained in one or more documents for the performance of work on an asbestos project and includes all labor, goods and service.

Asbestos handler - An individual who installs, removes, applies, encapsulates, or encloses asbestos or asbestos material, or who disturbs friable asbestos. Only individuals certified by NYS Department of Labor shall be acceptable for work under this specification.

Asbestos handling certificate - A certificate issued by the Commissioner of Labor of the State of New York, to a person who has satisfactorily completed an approved asbestos safety program.

Asbestos project - Work undertaken by a contractor which involves the installation, removal, encapsulation, application or enclosure of any ACM or the disturbance of friable ACM.

Asbestos Safety Technician (AST) - Individual designated to represent the Consultant, perform third party monitoring and perform compliance monitoring at the job site during the asbestos project.

Asbestos waste material - Asbestos material or asbestos contaminated objects requiring disposal.

Authorized visitor - The building owner, his or her representative or any representative of a regulatory or other agency having jurisdiction over the project.

Background level monitoring - A method used to determine ambient airborne concentrations inside and outside of a building or structure prior to starting an abatement project.

Building owner - The person in whom legal title to the premises is vested unless the premises are held in land trust, in which instance Building Owner means the person in whom beneficial title is vested.

Clean room - An uncontaminated area or room that is a part of the personal decontamination enclosure with provisions for storage of persons' street clothes and protective equipment.

Cleanup - The utilization of HEPA vacuuming to control and eliminate accumulations of asbestos material and asbestos waste material.

Clearance air monitoring - The employment of aggressive sampling techniques with a volume of air collected to determine the airborne concentration of residual fibers upon conclusion of an asbestos abatement project.

Commissioner - Commissioner of the New York State Department of Labor.

Contractor - A company, unincorporated association, firm, partnership or corporation and any owner or operator thereof, which engages in an asbestos project or employs persons engaged in an asbestos project.

Curtained doorway - A device that consists of at least three overlapping sheets of plastic over an existing or temporarily framed doorway. One sheet shall be secured at the top and left side, the second sheet at the top and right side, and the third sheet at the top and the left side. All sheets shall have weights attached to the bottom to ensure that the sheets hang straight and maintain a seal over the doorway when not in use.

Decontamination enclosure system - A series of connected rooms, separated from the work area and from each other by air locks, for the decontamination of persons, materials, equipment, and authorized visitors.

Encapsulant (sealant) or encapsulating agent - A liquid material that can be applied to asbestos material and which prevents the release of asbestos from the material by creating a membrane over the surface.

Enclosure - The construction of airtight walls, ceilings and floors between the asbestos material and the facility environment, or around surfaces coated with asbestos materials, or any other appropriate procedure that prevents the release of asbestos materials.

Equipment room - A contaminated area or room that is part of the personal decontamination enclosure system with provisions for the storage of contaminated clothing and equipment.

Fixed object - A unit of equipment, furniture or other fixture in the work area which cannot be readily removed from the work area.

Friable Asbestos Material - That condition of crumbled, pulverized, powdered, crushed or exposed asbestos capable of being released into the air by hand pressure.

Friable material containment - The encapsulation or enclosure of any friable asbestos material.

Glovebag technique - A method for removing asbestos material from heating, ventilating, and air conditioning (HVAC) ducts, piping runs, valves, joints, elbows, and other nonplanar surfaces in a noncontained work area. The glovebag assembly is a manufactured device consisting of a glovebag constructed of at least six mil transparent plastic, two inward-projecting longsleeve gloves, which may contain an inward projecting waterwand sleeve, an internal tool pouch, and an attached, labeled receptacle or portion for asbestos waste. The glovebag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and to contain all asbestos fibers released during the abatement process.

HEPA filter - A high efficiency particulate air filter capable of trapping and retaining 99.97 percent of particulate greater than 0.3 microns equivalent aerodynamic diameter.

HEPA vacuum equipment - Vacuuming equipment with a high efficiency particulate air filtration system.

Holding area - A chamber in the waste decontamination enclosure located between the washroom and an adjacent uncontaminated area.

Homogeneous work area - A site within the abatement work area that contains one type of asbestos material and where one type of abatement is used.

Large asbestos project - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 160 square feet or more of asbestos or asbestos material or 260 linear feet or more of asbestos or asbestos material.

Minor asbestos project - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material.

Movable object - A unit of equipment, furniture or fixture in the work area that can be readily removed from the work area.

Negative air pressure equipment - A local exhaust system equipped with HEPA filtration. The system shall be capable of creating and maintaining a negative pressure differential between the outside and the inside of the work area.

Non-asbestos material - Any material containing one percent or less asbestos by weight.

Occupied area - Any frequented portion of the work site where abatement is not taking place.

Outside air - The air outside the building or structure.

Personal air monitoring - A method used to determine an individual's exposure to airborne contaminants. The sample is collected outside the respirator in the person's breathing zone.

Plasticize - To cover floors, walls, ceilings and other surfaces with 6 mil fire retardant plastic sheeting as herein specified.

Project - Any form of work performed in connection with the abatement of asbestos or alteration, renovation, modification or demolition of a building or structure that may disturb asbestos or asbestos material.

Removal - The stripping of any asbestos material.

Repair - Corrective action using required work practices to control fiber release from damaged areas.

Respiratory protection - Respiratory protection required of licensed asbestos workers and authorized visitors in accordance with the applicable laws.

Satisfactory clearance air monitoring results - For all post- abatement samples, airborne concentrations of total fibers that are less than 0.01 fibers per cubic centimeter or background levels, whichever are greater, using phase contrast microscopy (PCM).

Shower room - A room between the clean room and the equipment room in the personal decontamination enclosure with hot and cold running water controllable at the top and arranged for complete showering during decontamination.

Small asbestos project - An asbestos project involving the installation, removal, disturbances, enclosure, or encapsulation of more than 10 and less than 160 square feet of asbestos or asbestos material of more than 25 and less than 260 linear feet of asbestos or asbestos material.

Staging area - The area near the waste transfer airlock where containerized asbestos waste has been placed prior to removal from the work area.

Surfactant - A chemical wetting agent added to water to improve its penetration.

Visible emissions - An emission of particulate material that can be seen without the aid of instruments.

Washroom - A room between the work area and the holding area in the waste decontamination enclosure system, where equipment and waste containers are wet cleaned and/or HEPA vacuumed.

Waste decontamination enclosure system - An area, consisting of a washroom and a holding area, designated for the controlled transfer of materials and equipment.

Wet cleaning - The process of eliminating asbestos contamination from surfaces, equipment or other objects by using cloths, mops, or other cleaning tools.

Work area - Designated rooms, spaces, or areas where asbestos abatement takes place.

Work site - Premises where asbestos abatement is taking place.

Work Surface - Substrate surface from which asbestos-containing material has been removed.

1.07 UTILITIES, SERVICE AND TEMPORARY FACILITIES

- A. The Owner shall make available to the Abatement Contractor all reasonable amounts of water and electrical power at no charge.
- B. The Abatement Contractor shall provide, at his own expense, all electrical, water, and waste connections, extensions, and construction materials, supplies, etc. All connections must be approved in advance by the Owner and all work relative to the utilities must be in accordance with the applicable building codes.
- C. The Abatement Contractor shall provide scaffolding, ladders and staging, etc. as necessary to accomplish the work of this contract. The type, erection and use of all scaffolding, ladders and staging, etc. shall comply with all applicable OSHA provisions.
- D. All connections to the Owner's water system shall include reduced pressure backflow protection or double check and double gate valves. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.
- E. The Abatement Contractor shall use only heavy-duty abrasion resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water to each work area and to each decontamination unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment. All water must be shut off at the end of each shift.

- F. The Abatement Contractor shall provide service to decontamination unit electrical subpanel with minimum 60-amp, 2 pole circuit breaker or fused disconnect and ground-fault circuit interrupters (GFCI), reset button and pilot light, connected to the building's main distribution panel. Subpanel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the work. This electrical subpanel shall be used for hot water heater, PAPR battery recharging and air sampling pumps.
- G. The Abatement Contractor shall provide UL rated 40-gallon electric hot water heater to supply hot water for the decontamination unit shower. Activate from 30-amp circuit breaker on the electrical subpanel located within the decontamination unit. Provide with relief valve compatible with water heater operation, relief valve down to drip pan on floor with type L copper. Wiring of the hot water heater shall follow NEMA, NEC, and UL standards.
- H. The Abatement Contractor shall provide identification warning signs at power outlets, which are other than 110-120-volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 plugs into higher voltage outlets. Dry transformers shall be provided where required to provide voltages necessary for work operations. All outlets or power supplies shall be protected by ground fault circuit interrupter (GFCI) at the power source.
- I. The Abatement Contractor shall use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.
- J. The Abatement Contractor shall provide general service incandescent lamps of wattage indicated or required for adequate illumination; Protect lamps with guard cages or tempered glass enclosures; Provide exterior fixtures where fixtures are exposed to moisture.
- K. The Abatement Contractor shall provide temporary heat or air conditioning as necessary to maintain comfortable working temperatures inside and immediately outside the work areas. Heating and A/C equipment shall have been tested and labeled by UL, FM or another recognized trade association related to the fuel being used. Fuel burning heaters shall not be used inside containment areas. The Contractor shall also provide a comfortable working environment for occupied areas that are impacted by the asbestos removal.
- L. The Abatement Contractor shall comply with recommendations of the NFPA standard in regard to the use and application of fire extinguishers. Locate fire extinguishers where they are most convenient and effective for their intended purpose but provide not less than one extinguisher in each work area, equipment room, clean room and outside the work area.

1.08 REMOVAL OF FIXTURES

- A. In locations where the Abatement Contractor is directed to dispose of fixtures, he shall either decontaminate the fixtures and dispose of them as non-asbestos containing materials or he shall place them in an appropriate container and dispose of them as asbestos containing material.
- B. In locations where the Abatement Contractor is directed to remove and reinstall fixtures, the fixtures shall be removed, decontaminated, labeled, protected with plastic and stored by the contractor in a location as directed by the Owner.

- C. Upon completion of the asbestos removal and upon receiving satisfactory clearance air monitoring results, all items to be replaced shall be restored to their original location and reinstalled by the Abatement Contractor.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. GENERAL REQUIREMENTS

1. Materials shall be stored off the ground, away from wet or damp surfaces and under protective cover to prevent damage or contamination.
2. Damaged or deteriorating materials shall not be used and shall be removed from the premises.
3. Power tools used to drill, cut into, or otherwise disturb asbestos material shall be equipped with HEPA filtered local exhaust ventilation.
4. The Abatement Contractor shall make available to authorized visitors, ladders and/or scaffolds of sufficient dimension and quantity so that all work surfaces can be easily and safely reached for inspection. Scaffold joints and ends shall be sealed with tape to prevent incursion of asbestos. Scaffolds and ladders shall comply with all applicable codes.

B. PLASTIC BARRIERS (POLYETHYLENE)

1. In sizes and shapes to minimize the number of joints.
 - a. Six mil. (.006") fire-retardant for vertical protection (walls, entrances and openings).
 - b. Six mil. (.006") fire-retardant for horizontal protection (fixed equipment) and heating grilles.
 - c. Six mil. (.006") reinforced fire-retardant for floors of decon units.
2. Provide two (2) layers over all roof, wall and ceiling openings. Floor penetrations shall be sealed with a rigid material prior to plasticizing to prevent tripping and fall hazards. All seams within a layer shall be separated by a minimum distance of six feet and sealed airtight. All seams between layers shall be staggered.
3. Barrier Attachment - Commercially available duct tape (fabric or paper) and spray-on adhesive. Duct tape shall be capable of sealing joints of adjacent sheets of plastic, facilitating attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials and adhering under both dry and wet conditions.

C. SIGNS

1. Danger signs shall be provided and shall conform to 29 CFR 1926.1101 and be 14" x 20". These signs shall bear the following information:

**DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE
CLOTHING
ARE REQUIRED IN THIS AREA**

D. DANGER LABELS AND TAPE

1. Labels shall be affixed to any asbestos contaminated material in accordance with the requirements of 29 CFR 1910.1200 (f) of OSHA's Hazard Communication Standard, and shall contain the following information:

**DANGER
CONTAINS ASBESTOS FIBERS
AVOID BREATHING DUST
CANCER AND LUNG DISEASE HAZARD**

2. A label shall be affixed on each container of asbestos waste in accordance with the requirements of 49 CFR Parts 171 and 172, Hazardous Substances; Final Rule (U.S. Department of Transportation), and shall contain the following information:

**RQ HAZARDOUS SUBSTANCE
SOLID, NOS, ORM-E, NA 9188
(ASBESTOS)**

3. A label shall be affixed on each container of asbestos waste in accordance with the requirements of 40 CFR Part 61.150, NESHAP; Asbestos; Final Rule (USEPA) and shall contain the name of the waste generator and the location at which the waste was generated.

NOTE: All containers marked as above (1,2 and 3) shall be disposed of as asbestos waste.

4. Provide 3" red barrier tape printed with black lettered "DANGER ASBESTOS REMOVAL". Locate barrier tape across all corridors, entrances and access routes to asbestos work area.

E. PROTECTIVE EQUIPMENT

1. Respiratory Requirements
 - a. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators are the minimum allowable respiratory protection permitted to be utilized during removal operations.

- b. Where not in violation of NIOSH, OSHA, and any other regulatory requirements, the Abatement Contractor shall provide the following minimum respiratory protection to the maximum use concentrations indicated:

<u>MSHA/NIOSH Approved Respiratory Protection</u>	<u>Maximum Use Concentration</u>
Half-Mask Air Purifying with HEPA Filters	10x PEL
Full-Facepiece Air Purifying HEPA Filters and Quantitative Fit Test	10x PEL
Powered Air Purifying (PAPR), Loose fitting Helmet or Hood, HEPA Filter	25x PEL
Powered Air Purifying (PAPR), Full Facepiece, HEPA Filter	50x PEL
Supplied Air, Continuous Flow Loose fitting Helmet or Hood	25x PEL
Supplied Air, Continuous Flow Full Facepiece, HEPA Filter	50x PEL
Full Facepiece-Supplied Air Pressure Demand, HEPA Filter	100x PEL
Full Facepiece-Supplied Air Pressure Demand, with Aux. SCBA, Pressure Demand or Continuous Flow	>100x PEL

2. Disposable Clothing - "Tyvek" manufactured by Dupont or approved equal.
3. NIOSH approved safety goggles to protect eyes.
4. Polyethylene bags, 6 mil. (.006") thick (use double bags).

NOTE: Workers must always wear disposable coveralls and respirator masks while in the work area. Contaminated coveralls or equipment must be left in work area and not worn into other parts of the building.

F. TOOLS AND EQUIPMENT

1. Airless Sprayer - An airless sprayer, suitable for application of encapsulating material, shall be used.

2. Scaffolding - Scaffolding, as required to accomplish the specified work, shall meet all applicable safety regulations.
3. Transportation Equipment - Transportation equipment, as required, shall be suitable for loading, temporary storage, transport and unloading of contaminated waste without exposure to persons or property. Watertight, hard wall containers shall be provided to retain and dispose of any asbestos waste material with sharp-edged components that may tear plastic bags or sheeting. The containers shall be marked with danger labels.
4. Surfactant - Wetting Agents - "Asbestos-Wet" - Aquatrols Corp. of America or approved equal and shall be non-carcinogenic.
5. Portable (negative air pressure) asbestos filtration system - by Micro-Trap or approved equal.
6. Vacuum, HEPA type equal to "Nilfisk" #GA73, or "Pullman/Holt" #75 ASA.
7. Amended Water Sprayer - The water sprayer shall be an airless or other low-pressure sprayer for amended water application.
8. Other Tools and Equipment - The Abatement Contractor shall provide other suitable tools for the stripping, removal, encapsulation, and disposal activities including but not limited to: hand-held scrapers, nylon brushes, sponges, rounded edge shovels, brooms, and carts.

PART 3 – EXECUTION

3.01 PRE-ABATEMENT WORK AREA PREPARATION

- A. The work area shall be vacated by the occupants prior to work area preparation and not reoccupied until satisfactory clearance air monitoring results have been achieved.
- B. Caution signs shall be posted at all locations and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted that permit a person to read the sign and take the necessary protective measures to avoid exposure.
- C. Shut down and lock out electric power to all work areas. The Abatement Contractor shall provide temporary power and lighting and ensure safe installation of temporary power sources and equipment used where high humidity and/or water shall be sprayed in accordance with all applicable codes. All power to work areas shall be brought in from outside the area through a ground-fault interrupter at the source.
- D. Isolate the work area HVAC system.
- E. The personnel decontamination enclosure system shall be installed or constructed prior to preparatory work in the work area and in particular before the disturbance of asbestos material. The waste decontamination enclosure system shall be installed or constructed prior to commencement of abatement activities.
- F. Movable objects within the work area shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning and such objects shall be removed from the work area to an uncontaminated location. If disposed of as asbestos waste material, cleaning is not required.

- G. Fixed objects and other items, which are to remain within the work area, shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Such objects shall be enclosed with two layers of at least six mil plastic sheeting and sealed with tape.
- H. The work area shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters, shall be prohibited. Asbestos material shall not be disturbed during pre-cleaning.
- I. Isolation barriers that seal off all openings, including windows, corridors, doorways, ducts, and any other penetrations of the work area, shall be constructed using two layers of at least six mil fire-retardant plastic sheeting sealed with tape. Also, all seams in mechanical system components that pass through the work area shall be sealed. Doorways and corridors, which shall not be used for passage during work, shall also be sealed.
- J. Removal of mounted objects. After isolation barriers are in place, objects such as light fixtures, electrical track, alarm systems, ventilation equipment and other items not previously sealed, shall be double sealed with six mil fire-retardant plastic sheeting. Localized HEPA filtered vacuum equipment shall be used during fixture removal to reduce asbestos dispersal.
- K. Individual roof and floor drains shall be sealed watertight using two layers of 6-mil fire-retardant plastic sheeting and tape prior to plasticizing. Openings in floor shall be fully covered with plywood sheeting secured to the floor in such a way as to minimize a tripping hazard prior to plasticizing.
- L. Emergency and fire exits from the work area shall be maintained or alternate exits shall be established according to all applicable codes.
- M. Adequate toilet facilities shall be supplied by the Abatement Contractor and shall be located either in the clean area of the personnel decontamination enclosure or shall be readily accessible to the personnel decontamination enclosure.

3.02 LARGE ASBESTOS PROJECT PERSONNEL DECONTAMINATION ENCLOSURE SYSTEM (ICR 56-7.5)

- A. The personnel decontamination enclosure shall be constructed prior to preparatory work in the work area and in particular before the disturbance of asbestos material.
 - 1. Construction and use of personnel decontamination enclosure systems shall be in accordance with ICR-56 and any Applicable or Site-Specific Variances utilized on this project. Such systems may consist of existing rooms outside of the work area, if the layout is appropriate, that can be enclosed is plastic sheeting and are accessible from the work area. When this situation does not exist, enclosure systems may be constructed out of metal, wood or plastic support.
 - 2. The personnel decontamination enclosure system shall consist of a clean room, a shower room, and an equipment room, in series, separated from each other and from the work area by three airlocks.
 - 3. There shall be one shower per six full shift abatement persons calculated on the basis of the largest shift.

4. The personnel decontamination enclosure system shall be fully framed, sheathed for safety and constructed to prevent unauthorized entry.
5. Personnel decontamination enclosure systems constructed at the work site shall utilize at least six mil fire-retardant opaque plastic sheeting. At least two layers of six mil fire-retardant reinforced plastic sheeting shall be used for the flooring of this area.
6. All prefabricated decontamination units shall be completely decontaminated and sealed prior to separation and removal from the work area. Mobile decontamination units shall remain in place until satisfactory clearance results have been attained.
7. The clean room shall be sized to accommodate all authorized persons. Benches, lockers and hooks shall be provided for street clothes. Shelves for storing respirators shall also be provided. Clean clothing, replacement filters for respirators, towels and other necessary items shall be provided. The clean room shall not be used for the storage of tools, equipment or materials. It shall not be used for office space. A lockable door shall be provided to permit access to the clean room from outside the work area or enclosure. It shall be used to secure the work area and decontamination enclosure during off-shift hours.
8. The shower room shall contain one or more showers. Each shower head shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to ensure against leakage of any kind. Uncontaminated soap, shampoo and towels shall be available at all times. Shower water shall be drained, collected and filtered through a system with at least 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos waste. The shower room shall be constructed in such way that travel through the decontamination unit shall be through the shower.
9. The equipment room shall be used for the storage of equipment and tools after decontamination using a HEPA filtered vacuum and/or wet cleaning. A one day supply of replacement filters, in sealed containers, for HEPA vacuums and negative pressure ventilation equipment, extra tools, containers of surfactant and other materials and equipment that may be required during the abatement project may also be stored here. A walk-off pan filled with water shall be located in the work area just outside the equipment room for persons to clean foot covering when leaving the work area. A drum lined with a labeled, at least six mil plastic bag is required for collection of clothing and shall be located in this room. Contaminated footwear and work clothes shall be stored in this area.

3.03 WASTE DECONTAMINATION ENCLOSURE SYSTEM (ICR 56-7.5)

A. General Requirements

1. A waste decontamination enclosure system shall consist of the following:
 - a. A washroom/cleanup room shall be constructed with an airlock doorway to the work area and another airlock doorway to the holding area.
 - b. The holding area shall be constructed with an airlock doorway to the washroom/cleanup room and another lockable door to the outside.

2. Where there is only one egress from the work area, the holding area of the waste decontamination enclosure system may branch off from the equipment decontamination room, which doubles as a waste washroom, of the personnel decontamination enclosure.
3. The waste washroom shall be equipped with a drain installed to collect water and deliver it to the shower drain where it shall be filtered through a system with at least 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos waste.
4. The waste washroom shall be constructed in such a way that travel through the rooms shall be through the waste washroom

3.04 WORK AREA ENTRY AND EXIT PROCEDURES

- A. The following procedures shall be followed throughout the asbestos abatement project until satisfactory clearance air monitoring results have been achieved:
 1. All persons shall enter and exit the work area through the personnel decontamination enclosure system.
 2. All persons who enter the work area or an enclosure shall sign the entry/exit log, located in the clean room, upon every entry and exit.
 3. All persons, before entering the work area, or an enclosure shall read and be familiar with all posted regulations, personal protection requirements, including work area entry and exit procedures, and emergency procedures. The entry/exit log headings shall indicate, and the signatures shall be used to acknowledge, that these have been reviewed and understood by all persons prior to entry.
 4. All persons shall proceed first to the clean room, remove all street clothing, store these items in clean sealable plastic bags or lockers and don coveralls, head covering, foot covering and gloves. All persons shall also don NIOSH approved respiratory protection. Clean respirators and protective clothing shall be utilized, by each person, for each separate entry into the work area. Respirators shall be inspected prior to each use and tested for proper seal using quantitative or qualitative fit checks.
 5. Persons wearing designated personal protective equipment shall proceed from the clean room through the shower room to the equipment room, where necessary tools are collected and any additional clothing shall be donned, before entry into the work area.
 6. Before leaving the work area, all persons shall remove gross contamination from the outside of respirators and protective clothing by brushing, wet cleaning, and/or HEPA vacuuming.
 7. Persons shall proceed to the equipment room where all coveralls, head covering, foot covering and gloves shall be removed. Disposable clothing shall be deposited into labeled containers for disposal. Reusable contaminated clothing, footwear, head gear and gloves shall be stored in the equipment room when not being used in the work area.

8. Still wearing respirators, persons shall proceed to the shower area, clean the outside of the respirator and the exposed face area under running water prior to removal of the respirator, and then fully and vigorously shower and shampoo to remove residual asbestos contamination. Respirators shall be washed thoroughly with soap and water. Some types of respirators will require slight modification of these procedures. An airline respirator with HEPA filtered disconnect protection shall be disconnected in the equipment room and worn into the shower. A powered air-purifying respirator facepiece shall be disconnected from the filter/power pack assembly prior to entering the shower.
9. After showering and drying, all persons shall proceed to the clean room and don clean personal protective equipment if returning to the work area or street clothing if exiting the enclosure.

3.05 EQUIPMENT AND WASTE CONTAINER DECONTAMINATION & REMOVAL PROCEDURES

- A. The following procedures shall be followed throughout the asbestos abatement project until satisfactory clearance air monitoring results have been achieved.
 1. External surfaces of contaminated containers and equipment shall be cleaned by wet cleaning and/or HEPA vacuuming in the work area before moving such items into the waste decontamination enclosure system airlock by persons assigned to this duty. These work area persons shall not enter the airlock.
 2. These contaminated items shall be removed from the airlock by persons stationed in the washroom during waste removal operations. These washroom persons shall remove gross contamination from the exterior of their respirators and protective clothing by brushing, HEPA vacuuming and/or wet cleaning.
 3. Once in the waste decontamination enclosure system, external surfaces of contaminated containers and equipment shall be cleaned a second time by wet cleaning.
 4. The cleaned containers of asbestos material and equipment are to be dried of any excessive pooled or beaded liquid, placed in uncontaminated plastic bags or sheeting and sealed airtight.
 5. The clean recontainerized items shall be moved into the airlock that leads to the holding area. The washroom persons shall not enter this airlock or the work area until waste removal is finished for that period.
 6. Containers and equipment shall be moved from the airlock and into the holding area by persons dressed in clean personal protective equipment, who have entered from uncontaminated areas.
 7. The cleaned containers of asbestos material and equipment shall be placed in water tight carts with doors or tops that shall be closed and secured. These carts shall be held in the holding area pending removal. The carts shall be wet cleaned and/or HEPA vacuumed at least once each day.
 8. The exit from the decontamination enclosure system shall be secured to prevent unauthorized entry.

9. Where the waste removal enclosure is part of the personnel decontamination enclosure, waste removal shall not occur during shift changes or when otherwise occupied. Precautions shall be taken to prevent short circuiting and cycling of air outward through the shower and clean room.
10. Containers labeled with Asbestos hazard warnings shall not be used to dispose of non asbestos waste.

3.06 ENGINEERING CONTROLS

A. Ventilation.

1. The Abatement Contractor shall employ HEPA equipped vacuums or negative air pressure equipment for ventilation as required.
2. All negative air pressure equipment ventilation units shall be equipped with HEPA filtration. The Contractor shall provide a manufacturer's test certificate for each unit documenting the capability of trapping and retaining 99.97 percent of asbestos fibers greater than 0.3 microns equivalent aerodynamic diameter.
3. A power supply shall be available to satisfy the requirements of the total of all ventilating units.
4. On electric power failure, abatement shall stop immediately and shall not resume until power is restored and exhaust units are operating fully. On extended power failure, longer than one hour, the decontamination facilities, after the evacuation of all persons from the work area, shall be sealed airtight.
5. If extending the exhaust of the ventilation units 50 feet from the building would result in an exhaust location either in the road, blocking driveway access to the facility or within 50 feet of other buildings, a second unit will be run in series with the primary unit.

3.07 MAINTENANCE OF DECONTAMINATION ENCLOSURE SYSTEMS AND WORK AREA BARRIERS

A. GENERAL REQUIREMENTS

1. The Consultant must review and approve installation before commencement of work. Upon completion of the construction of all plastic barriers and decontamination system enclosures and prior to beginning actual abatement activities.
2. All plastic barriers inside the work area, in the personnel decontamination enclosure system, in the waste decontamination enclosure system and at partitions constructed to isolate the work area from occupied areas, shall be inspected by the asbestos supervisor at least twice daily. The barriers shall be inspected before the start of and following the completion of the day's abatement activities. Inspections and observations shall be documented in the project log.
3. Damage and defects in the barriers and/or enclosure systems shall be repaired immediately upon discovery and prior to resumption of abatement activities.

4. At any time during the abatement activities, if visible emissions are observed outside of the work area or if damage occurs to the barriers, work shall be stopped, repairs made and visible residue immediately cleaned up using HEPA vacuuming methods prior to the resumption of abatement activities.
5. The Abatement Contractor shall HEPA vacuum and/or wet clean the waste decontamination enclosure system and the personnel decontamination enclosure system at the end of each day of abatement activities.

3.08 HANDLING AND REMOVAL PROCEDURES

The Abatement Contractor may utilize existing provisions of ICR-56, Applicable Variances or a Site Specific Variance, approved by the Owner's Consultant, to permit the conduct of this work.

3.09 ABATEMENT PROCEDURES

A. AIR SAMPLING - By Owner

1. Air sampling and analysis shall be conducted according to the requirements of Subpart 56-4 before the start, during and after the completion of the asbestos removal project.
2. In addition to the requirements of Subpart 56-4, air monitoring shall be conducted in accordance with any approved job specific variance(s) or applicable variance utilized.
3. Clearance samples may be analyzed using PCM to maintain compliance with ICR-56.
4. If applicable, clearance samples will be analyzed using TEM to maintain compliance with ICR-56 and 40 CFR 763.90[i].

B. The provisions of the Applicable Variances or a Job Specific Variance shall apply only in those areas where approval has been granted by the NYS DOL and the Contractor has obtained concurrence from the Owner's Consultant. All other applicable provisions of Industrial Code Rule 56-1 through 56-12 shall be complied.

C. A copy of the NYS DOL Job Specific or Applicable Variance, if applicable, shall be conspicuously posted at the work area(s).

D. The Abatement Contractor shall construct a decontamination unit at the work site. The Abatement Contractor shall, as a minimum, comply with the requirements of 29 CFR 1926.1101(j); Hygiene facilities and practices for employees.

3.10 ENCAPSULATION PROCEDURES

The following procedures shall be followed to seal in non-visible residue, after obtaining satisfactory clearance air monitoring results, while conducting lockdown encapsulation on any surfaces which were the subject of removal or other remediation activities:

- A. Only encapsulants rated as acceptable or marginally acceptable on the basis of Battelle Columbus Laboratory test procedures and rating requirements developed under the 1978 USEPA contract shall be used for lockdown encapsulation.

- B. Sealants considered for use in encapsulation shall first be tested to ensure that the sealant is adequate for its intended use. A section of the work surface shall be evaluated following this initial test application of the sealant to quantitatively determine the sealant's effectiveness in terms of penetrating and locking down the asbestos fibers. The American Society of Testing and Materials (ASTM) Committee E06.21.06E on Encapsulation of Building Materials has developed a guidance document to assist in the selection of an encapsulant.
- C. The encapsulant solvent or vehicle shall not contain a volatile hydrocarbon.
- D. Encapsulants shall be applied using airless spray equipment.
 - 1. Spraying is to occur at the lowest pressure range possible to minimize fiber release from encapsulant impact at the surface. It shall be applied with a consistent horizontal or vertical motion.
- E. Encapsulation shall be utilized as a surface sealant once all asbestos containing materials have been removed in a work area. In no event shall encapsulant be applied to any surface that was the subject of removal or other remediation activities prior to obtaining satisfactory clearance air monitoring.

3.11 CLEANUP PROCEDURES

- A. The following cleanup procedures shall be required.
 - 1. Cleanup of accumulations of loose asbestos material shall be performed whenever enough loose asbestos materials have been removed to fill a single leak tight container of the type commensurate with the material properties. In no case shall cleanup be performed less than once prior to the close of each working day. Asbestos material shall be kept wet until cleaned up.
 - 2. Accumulations of dust shall be cleaned off all surfaces on a daily basis using HEPA vacuum cleaning methods.
 - 3. Decontamination enclosures shall be HEPA vacuumed at the end of each shift.
 - 4. Accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dust pans, squeegees or shovels. Metal shovels shall not be used to pick up or move waste.
 - 5. Excessive water accumulation or flooding in the area shall require work to stop until the water is collected and disposed of properly.
- B. The following cleanup procedures shall be required after completion of all removal activities.
 - 1. All accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dust pan, squeegees or shovels. Metal shovels shall not be used to pick up or move waste. HEPA vacuums shall be used to clean all surfaces after gross cleanup.
 - 2. Cleaning. All surfaces in the work area shall be HEPA vacuumed. To pick up excess liquid and wet debris, a wet purpose shop vacuum may be used and shall be decontaminated prior to removal from the work area.

3. Windows, doors, HVAC system vents and all other openings shall remain sealed. Decontamination enclosure systems shall remain in place and be utilized.
4. All containerized waste shall be removed from the work area and the holding area.
5. All tools and equipment shall be decontaminated and removed from the work area.
6. A final visual inspection and clearance air monitoring, as per the schedule for air sampling and analysis, shall be conducted.
7. The isolation barriers and decontamination unit shall be removed only after satisfactory clearance air monitoring results have been achieved.

3.12 SAFETY MONITORING – CONSULTANT:

The Consultant will designate an Asbestos Safety Technician (AST) to represent the Owner during the removal program. The AST must be on the job site at all times during abatement work. Absolutely no abatement or preparation work will occur without the presence of the AST.

The AST will conduct four (4) milestone inspections.

1. Pre-commencement inspection shall be conducted as follows:
 - a. Notification in writing to the Consultant shall be made by the Abatement Contractor to request a pre-commencement inspection at least 48 hours in advance of the desired date of inspection. This inspection shall be requested prior to beginning preparatory work in another work area.
 - b. The AST shall ensure that:
 - i. The job site is properly prepared and that all containment measures are in place;
 - ii. The designated supervisor shall present to the inspector a valid supervisor's license issued by the New York Department of Labor;
 - iii. All workers shall present to the inspector a valid handler's license issued by the New York Department of Labor;
 - iv. Measures for the disposal of removed asbestos material are in place and shall conform to the adopted standards;
 - v. The Abatement Contractor has a list of emergency telephone numbers at the job site which shall include the monitoring firm employed by the Owner and telephone numbers for fire, police, emergency squad, local hospital and health officer.
 - c. If all is in order, the AST shall issue a written notice to proceed in the field. If the job site is not in order, then any needed corrective action must be taken before any work is to commence. Conditional approvals shall not be granted.

Progress inspection shall be conducted as follows:

- a. Primary responsibility for ensuring that the abatement work progresses in accordance with these technical specifications and regulatory requirements rests with the Abatement Contractor. The AST shall continuously be present to observe the progress of work and perform required tests.
- b. If the AST observes irregularities at any time, he shall direct such corrective action as may be necessary. If the Abatement Contractor fails to take the corrective action required, or if the Abatement Contractor or any of their employees habitually and/or excessively violate the requirements of any regulation, then the AST shall inform the Owner who shall issue a Stop Work Order to the Abatement Contractor and have the work site secured until all violations are abated.

Clean-up inspections shall be conducted as follows:

- a. Notice for clean-up inspection shall be requested by the Abatement Contractor at least 24 hours in advance of the desired date of inspection;
 - b. The clean-up inspection shall be conducted prior to the removal of any isolation or critical barriers and before final air clearance monitoring;
 - c. The AST shall ensure that:
 - i. The work site has been properly cleaned and is free of visible asbestos containing material and debris.
 - ii. All removed asbestos has been properly placed in a locked secure container outside of the work area.
 - d. If all is in order, the AST shall issue a written notice of authorization to remove surface barriers from the work area. All isolation barriers shall remain in place until satisfactory clearance air sampling has been completed.
4. Clearance Visual Inspection shall be conducted after the removal of non-critical plastic sheeting. The AST shall insure that:
- a. The work area is free of all visible asbestos or suspect asbestos debris and residue.
 - b. All waste has been properly bagged and removed from the work area.
 - c. Should clearance visual inspection identify residual debris, as determined by the AST, the Abatement Contractor is responsible for recleaning the area at his own cost and shall bear all costs of reinspection until acceptable levels are achieved.
- B. The Abatement Contractor shall be required to receive written approval before proceeding after each milestone inspection.

3.13 PERSONNEL AIR MONITORING – CONTRACTOR (29 CFR 1926.1101)

- A. Personnel air monitoring shall be provided to determine both short-term (STEL) and full shift during when abatement activities occur. Personnel sampling shall be performed in each work area in order to accurately determine the concentrations of airborne asbestos to which workers may be exposed.
- B. The Abatement Contractor shall have a qualified "Competent Person" (as specified in 29 CFR 1926 OSHA) to conduct personnel air monitoring.
- C. The laboratory performing the air sample analysis shall be certified by NYS DOH ELAP and approved by the consultant.
- D. Personnel air monitoring test results for OSHA Compliance. Results shall be posted at the work site within 24 hours of testing and copies supplied to the Owner within five (5) days of testing. Abnormalities shall be supplied to the Owner immediately.

3.14 CLEARANCE AIR MONITORING

- A. Air samples will be collected in and around the work areas at the completion of abatement activities.
- B. Clearance samples may be analyzed using PCM to maintain compliance with ICR-56.
- C. If applicable, clearance samples will be analyzed using TEM to maintain compliance with ICR-56 and 40 CFR part 763 "Asbestos-Containing Materials in Schools; Final Rule and Notice" section 763.90.
- D. ***RETESTING***
Should clearance air monitoring yield fiber concentrations above the "Clearance" criteria of either 0.01 fibers per CC and/or background levels (PCM) –OR- seventy (70) structures per square millimeter (TEM/AHERA), the Abatement Contractor is responsible for re-cleaning the area at his own cost and shall bear all costs associated with the retesting of the work area(s) including monitoring labor, sampling, analysis, etc. until such levels are achieved.

3.15 RESPIRATORY PROTECTION REQUIREMENT

- A. Respiratory protection shall be worn by all individuals inside the work area from the initiation of the asbestos project until all areas have successfully passed clearance air monitoring in accordance with these specifications. The Abatement Contractor shall keep available at all times two PAPR's with new filters and charged batteries for use by authorized visitors.
- B. All respiratory protection shall be MSHA/NIOSH approved in accordance with the provisions of 30 CFR Part II. All respiratory protection shall be provided by the Abatement Contractor, and used by workers in conjunction with the written respiratory protection program.
- C. The Abatement Contractor shall provide respirators that meet the requirements of 29 CFR Parts 1910 and 1926.

1. Full facepiece Type C supplied-air respirators operated in pressure demand mode equipped with an auxiliary self-contained breathing apparatus, operated in pressure demand or continuous flow, shall be worn during gross removal, demolition, renovation and/or other disturbance of ACM whenever airborne fiber concentrations inside the work area are greater than 10.0 f/cc.
 2. Full facepiece Type C supplied-air respirators operated in pressure demand mode with HEPA filter disconnect protection shall be worn during gross removal, demolition, renovation and/or other disturbance of ACM with an amphibole content and/or whenever airborne fiber concentrations inside the work area are equal to or greater than 0.5 f/cc and less than or equal to 10.0 f/cc.
 3. Full facepiece powered air-purifying respirators (PAPR) equipped with HEPA filters shall be worn during the removal, encapsulation, enclosure, repair and/or other disturbance of friable ACM if airborne fiber concentrations inside the work area are less than 0.5 f/cc. A supply of charged replacement batteries, HEPA filters and flow test meter shall be available in the clean room for use with powered air-purifying respirators. HEPA filters shall be changed daily or as flow testing indicates change is necessary. Any Type C supplied-air respirator operated in continuous flow, with HEPA filter disconnect protection, may be substituted for a powered air-purifying respirator.
 4. Loose fitting helmets or hoods with powered air-purifying respirators (PAPR) equipped with HEPA filters may be worn during the removal, encapsulation, enclosure, repair and/or other disturbance of friable ACM if airborne fiber concentrations inside the work area are less than 0.25 f/cc. A supply of charged replacement batteries, HEPA filters and flow test meter shall be available in the clean room for use with powered air-purifying respirators. HEPA filters shall be changed daily or as flow testing indicates change is necessary. Any Type C supplied-air respirator operated in continuous flow may be substituted for a powered air-purifying respirator.
 5. Half-mask or full-face air-purifying respirators with HEPA filters shall be worn only during the preparation of the work area and final clean up procedures provided airborne fiber concentrations inside the work area are less than 0.1 f/cc.
 6. Use of single use dust respirators is prohibited for the above respiratory protection.
- D. Workers shall be provided with personally issued and individually marked respirators. Respirators shall not be marked with any equipment that will alter the fit of the respirator in any way. Only waterproof identification markers shall be used.
- E. The Abatement Contractor shall ensure that the workers are qualitatively or quantitatively fit tested by an Industrial Hygienist initially and every six months thereafter with the type of respirator he/she will be using.
- F. Whenever the respirator design permits, workers shall perform the positive and negative air pressure fit test each time a respirator is worn. Powered air-purifying respirators shall be tested for adequate flow as specified by the manufacturer.
- G. No facial hair, which interferes with the face-to-mask sealing surface, shall be permitted to be worn when wearing respiratory protection that requires a mask-to-face seal.
- H. Contact lenses shall not be worn in conjunction with respiratory protection.

- I. If a worker wears glasses, a spectacle kit to fit their respirator shall be provided by the Abatement Contractor at the Abatement Contractor's expense.
- J. Respiratory protection maintenance and decontamination procedures shall meet the following requirement:
 1. Respiratory protection shall be inspected and decontaminated on a daily basis in accordance with OSHA 29 CFR 1910.134(b); and
 2. HEPA filters for negative pressure respirators shall be changed after each shower; and
 3. Respiratory protection shall be the last piece of worker protection equipment to be removed. Workers must wear respirators in the shower when going through decontamination procedures; and
 4. Airline respirators with HEPA filtered disconnect shall be disconnected in the equipment room and worn into the shower. Powered air-purifying respirator facepieces shall be worn into the shower. Filtered/power pack assemblies shall be decontaminated in accordance with manufacturers' recommendations; and
 5. Respirators shall be stored in a dry place and in such a manner that the facepiece and exhalation valves are not distorted; and
 6. Organic solvents shall not be used for washing of respirators.
- K. No visitors shall be allowed to enter the contaminated area if they do not have their medical certification and training certificate. Authorized visitors shall be provided with suitable PAPR respirators and instructions on the proper use of respirators whenever entering the work area.

3.16 DISPOSAL OF WASTE

A. APPLICABLE REGULATIONS

1. All asbestos waste shall be stored, transported and disposed of as per, but not limited to, the following Regulations:
 - a. NYS Code Rule 56
 - b. U.S. Department of Transportation (DOT)
Hazardous Substances
Title 29, Part 171 and 172 of the code of Federal Regulations
regarding waste collector registration
 - c. Regulations regarding waste collector registration Title 6, part 364 of the New York State Official Compilation of Codes, Rules and Regulations – 6 NYCRR 364
 - d. USEPA NESHAPS 40 CFR 61
 - e. USEPA ASBESTOS WASTE MANAGEMENT GUIDANCE EPA/530-SW-85-007

- B. TRANSPORTER OR HAULER - The Abatement Contractor shall bear full responsibility for proper characterization, transportation and disposal of all solid or liquid waste, generated during the project, in a legal manner. The Owner shall approve all transportation and disposal methods.
1. The Abatement Contractor's Transporter (hauler) and disposal site shall be approved by the Owner. The Abatement Contractor shall remove within 48 hours all asbestos waste from the site after completing the clean up.
 2. The Transporter must possess and present to the Owner's representative a valid New York State Department of Environmental Conservation Part 364 asbestos hauler's permit to verify license plate and permit numbers. The Owner's representative will verify the authenticity of the hauler's permit with the proper authority.
 3. The Abatement Contractor shall give 24 hour notification prior to removing any waste from the site. All waste shall be removed from site only during normal working hours. No waste may be taken from the site without authorization from the Owner's representative.
 4. The Abatement Contractor shall have the Transporter give the date and time of arrival at the disposal site.
 5. The Transporter with the Abatement Contractor and Owner's consultant shall inspect all material in the transport container prior to taking possession and signing the Waste Manifest. The Transporter shall not have any off site transfers or be combined with any other off-site asbestos material.
 6. The Transporter must travel directly to the disposal site with no unauthorized stops.

C. WASTE STORAGE CONTAINER

1. During loading and on site storage, the asbestos waste container shall be labeled with EPA Danger signage:

**DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD**

2. The NYS DEC Hauler's Permit number shall be on both sides and back of the container.
3. The Container will not be permitted to leave the site without the proper signage.
4. A copy of the completed waste manifest shall be forwarded directly to the Owner's Consultant by the disposal facility.

5. Packaging of Non-friable Asbestos. Use of an open top container shall require written request, by the Contractor, and written approval by the Owners Representative, and be performed in compliance with all applicable regulations.
 - a) A chute, if used, shall be air/dust tight along its lateral perimeter and at the terminal connection to the dumpster at ground level (solid wall and top container). The upper end of the chute shall be furnished with a hinged lid, to be closed when the chute is not being used.
 - b) The container shall be lined with a minimum of two (2) layers of 6 mil. Fire-retardant polyethylene draped loosely over the sides so as to facilitate being wrapped over the top of the load and sealed prior to transport from the site.
 - c) Prior to transport from the work site the Dumpster will be disconnected from the chute and sealed air/dust tight utilizing six mil plastic and tape. The waste material will be transported as an asbestos containing material by appropriate legal methods.
6. Packaging Friable Asbestos.
 - a) The container shall be a solid wall, hard top and lockable container.
 - b) The container shall be locked upon arrival at the site to restrict access. Security shall be provided at the entrance to the container during the loading process and immediately locked upon completion.
 - c) The interior walls, floor and ceiling shall be lined with two (2) layers of 6 mil. Fire-retardant polyethylene.
 - d) The waste shall be loaded in such a manner as to protect the integrity of the individual waste packages.
 - e) Prior to transport from the work site the interior of the Dumpster will sealed air/dust tight utilizing six mil plastic and tape. The waste material will be transported as an asbestos containing material by appropriate legal methods.

D. WASTE DISPOSAL MANIFEST

1. The Asbestos Waste Manifest shall be equivalent to the "Waste Shipment Record" included in 40 CFR 61. A copy of the Contractor's manifest shall be reviewed by the Owner's Consultant and shall be the only manifest used.
2. The Manifest shall be verified by the Owner's Consultant indicating that all the information and amounts are accurate and the proper signatures are in place.
3. The Manifest shall have the signatures of the Abatement Contractor and the Transporter prior to any waste being removed from the site.

4. The Manifest shall be signed by the Disposal Facility owner or operator to certify receipt of asbestos containing materials covered by the manifest.
5. A copy of the completed manifest shall be provided by the Abatement Contractor to the Owner's Consultant and remain on site for inspection.
6. Abatement Contractor shall maintain a waste disposal log which indicates load number, date and time left site, container size, type of waste, quantity of waste, name of hauler, NYS DES permit number, trailer and tractor license number, and date manifest was returned to Consultant.
7. The Disposal Facility owner or operator shall return a signed copy of the Waste Manifest directly to:

**Ossining UFSD
400 Executive Boulevard
Ossining, New York 10562
ATTN: Jared Mance**

8. Copies of the completed Waste Manifest are to be sent by the disposal facility to the Hauler and Abatement Contractor.
9. Submit signed dump tickets and manifests with final payment request.
10. Final payment request will not be honored without signed dump ticket or manifests accounting for all asbestos waste removed from the site.

E. VIOLATIONS OF SPECIFICATIONS

1. Violations of the safety, hygiene, environmental, procedures herein, any applicable federal, state or local requirements or failure to cooperate with the Owner's representative shall be grounds for dismissal and/or termination of this contract.

F. VIOLATIONS OF NO SMOKING POLICY

1. The Federal Pro Children Act of 1994 prohibits School District Officials from smoking in any buildings or on the grounds that is property of the School District. The District shall be considered smoke free. The School District strongly enforces its' No Smoking Policy. It is the Contractor's responsibility to inform all workers of this policy. Any worker(s) involved with this project that are found smoking or using tobacco products will be informed that they are in violation of the Federal and State Law and School Board Policy and will be removed from site.

3.17 LOCATION OF “ABATEMENT WORK”

(Please see attached Drawings for approximate locations)

1) OSSINING HIGH SCHOOL (INTERIOR ABATEMENTS)

- Abatement Contractor responsible for total and complete removal and disposal of approximately 20 SF of non-friable asbestos-containing Floor Tiles, Mastics and/or Floor Fillers, as detailed on the attached ACM Location Drawing. Removals shall include all flooring system layers to building substrate(s) beneath, consisting of: ACM Floor Tiles/Mastics/fillers over Non-ACM Cementitious Slab(s). Subsequent to final air clearance, the substrate shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering(s) and eliminate residual odors. The General Contractor responsible for re-installation of non-asbestos floor coverings/mastics. See below for breakdown:
 - 2nd Floor Connector Corridor – ACM Floor Tiles and Mastic (20 SF)
- Abatement Contractor responsible for total and complete removal and disposal of approximately 250 SF of non-friable presumed asbestos-containing Chalkboards/Tackboards and Associated Adhesive/Glue Dabs, as detailed on attached ACM Location Drawings. Abatement Contractor responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). See below for breakdown:
 - Classroom 301 – PACM Chalk/Tackboards and Adhesive/Glue Dabs (250 SF)
- Abatement Contractor responsible for total and complete removal and disposal of approximately 200 LF of friable asbestos-containing Pipe Insulation/Mudded Joint Packing (Elbows) as detailed on attached ACM Location Drawings. Abatement Contractor responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). See below for breakdown:
 - 1st Floor Connector Corridor Above Suspended Ceiling – ACM Pipe Insulation/MJP's (75 LF)
 - 2nd Floor Connector Corridor Above Suspended Ceiling – ACM Pipe Insulation/MJP's (125 LF)

2) OSSINING HIGH SCHOOL (EXTERIOR ABATEMENTS)

- Abatement Contractor responsible for total and complete removal and disposal of approximately 30 LF of non-friable asbestos-containing Termination Bar Caulk, as detailed on attached ACM Location Drawings. Abatement Contractor responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). Temporary security and environmental protection throughout remaining opening shall be coordinated with and provided by the General Contractor.
- Abatement Contractor responsible for total and complete removal and disposal of approximately 70 SF of non-friable asbestos-containing Damp Proofing, behind non-ACM brick facade, as detailed on attached ACM Location Drawings. Abatement Contractor responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). Temporary security and environmental protection throughout remaining openings shall be coordinated with and provided by the General Contractor.

END OF LOCATION OF WORK

3.18 GENERAL

- A. The Abatement Contractor will be responsible for repairing all building components damaged during abatement including, but not limited to: ceiling tiles, ceiling finishes, wall finishes, floor finishes, etc.
- B. The Abatement Contractor shall be responsible for all demolition required to access materials identified in scope of work and on associated drawings.
- C. Concealed conditions that are exposed and may require additional work shall be brought to the attention of the Owner immediately. The Abatement Contractor shall not abate these areas without a written notice to proceed. Additional asbestos abatement performed prior to the order to proceed will not be acknowledged.
- D. The Abatement Contractor shall remove asbestos-containing floor covering to the building substrate beneath; in areas indicted. Subsequent to final air clearance the substrate shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering and eliminate residual odors.
- E. Power tools used to drill, cut into or otherwise disturb asbestos containing material shall be equipped with HEPA filtered local exhaust ventilation.
- F. The Abatement Contractor shall provide access to GFCI electrical power, required to perform the area air monitoring for this project, within and immediately adjacent to each work area.
- G. Unwrapped or unbagged ACM shall be immediately placed in an impermeable waste bag or wrapped in plastic sheeting.
- H. Coordinate all removal operations with the Owner.

**Asbestos Employee Medical Examination Statement
Certificate of Worker Release
Asbestos Employee Training Statement
CERTIFICATE OF WORKERS'S ACKNOWLEDGEMENT**

PROJECT NAME: **Ossining UFSD: Ossining HS 3rd Floor Connector Addition**

CONTRACTOR'S NAME: _____

WORKING WITH ASBESTOS INVOLVES POTENTIAL EXPOSURE TO AIRBORNE ASBESTOS FIBERS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER AND RESPIRATORY DISEASES. SMOKING CIGARETTES AND INHALATION OF ASBESTOS FIBERS INCREASES THE RISK THAT YOU WILL DEVELOP LUNG CANCER ABOVE THAT OF THE NON-SMOKING PUBLIC.

The Contract for this project requires your employer to 1) supply proper respiratory protection devices and training on their use 2) provide training on safe work practices and on use of the equipment used on the project 3) provide a medical examination meeting the requirements of 29 CFR 1926.1101. Your signature on this certificate, documents that your employer has fulfilled these contractual obligations and you understand the information presented to you.

*******DO NOT SIGN THIS FORM UNLESS YOU FULLY UNDERSTAND THIS INFORMATION*******

RESPIRATORY PROTECTION: I have been trained in the proper use and limitations of the type of respiratory protection devices to be used on this project. I have reviewed the written respiratory protection program manual and a copy is available for my use. Respiratory protection equipment has been provided, by the Contractor, at no cost to me.

TRAINING COURSE: I have been trained in the risks and dangers associated with handling asbestos, breathing asbestos dust, proper work procedures, personal protection and engineering controls. I have satisfactorily completed and Asbestos Safety Training Program for New York State and have been issued a New York State Department of Health Certificate of Asbestos Safety Training.

MEDICAL EXAMINATION: I have satisfactorily completed a medical examination within the last 12 months that meets the OSHA requirement for an asbestos worker and included at least 1) medical history 2) pulmonary function 3) medical examination 4) approval to wear respiratory protection devices and may have included an evaluation of a chest x-ray.

Signature: _____ Date _____

Printed Name: _____ SS#: _____

Witness: _____ Date: _____

Ossining UFSD: Ossining HS 3rd Floor Connector Addition

ESTIMATE OF ACM QUANTITIES

EACH ABATEMENT CONTRACTOR SHALL READ AND ACKNOWLEDGE THE FOLLOWING NOTICE. A SIGNED AND DATED COPY OF THIS ACKNOWLEDGMENT SHALL BE SUBMITTED WITH THE ABATEMENT CONTRACTOR'S BID FOR THIS PROJECT. FAILURE TO DO SO MAY, AT THE SOLE DISCRETION OF THE OWNER, RESULT IN THE BID BEING CONSIDERED NON-RESPONSIVE AND RESULT IN DISQUALIFICATION OF THE ABATEMENT CONTRACTOR'S BID ON THIS PROJECT.

*** NOTICE ***

The linear and square footages listed within this specification are approximates. Abatement Contractor is required to visit the work locations prior to bid submittal in order to take actual field measurements within each listed location. The Abatement Contractor shall base their bid on actual quantities determined, by them, at the site walkthrough. Estimates provided in these specifications are for informational purposes only and shall not be considered a basis for Change Orders on this project.

Acknowledgment: I have read and understand the above NOTICE regarding removal quantity estimates and understand that estimates provided in these specifications are for informational purposes only and shall not be considered a basis for Change Orders on this project. The Abatement Contractor's signatory represents to the Owner that he/she has the authority of the entity he/she represents to sign this agreement on its behalf.

Company Name: _____
Type or Print

BY: _____
Signature Title Date

Print Name: _____

ASSOCIATED ASBESTOS REMOVAL LOCATION DRAWINGS

➤ **Ossining UFSD: Ossining HS 3rd Floor Connector Addition**

- ❖ **OHS AA000** – Ossining High School – Asbestos Notes
- ❖ **OHS AA100** – Ossining High School – 1st Floor Asbestos Abatement Plan
- ❖ **OHS AA101** – Ossining High School – 2nd Floor Asbestos Abatement Plan
- ❖ **OHS AA102** – Ossining High School – 3rd Floor/Roof/Facade Asbestos Abatement Plan

END OF SECTION 020800

SECTION 02 4119 - SELECTIVE REMOVAL

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. Removal of selected portions of building or structure.
 - 2. Removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, removal waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during removal remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Pre-removal Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively removed.
 - 2. Review structural load limitations of existing structure.

3. Review and finalize selective removal schedule and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective removal operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Schedule of Selective Removal Activities: Indicate the following:
 1. Detailed sequence of selective removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Coordination of Owner's continuing occupancy of portions of existing building.
- C. Pre-removal Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by removal operations.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- E. Submit shoring and protection plans as per 3.4 A & B.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective removal area. Conduct selective removal so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 1. Before selective removal, Owner will remove the following items:

- a. Any items to be retained by the Owner will have been removed by the Owner prior to start of work.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Present in buildings and structures to be selectively removed. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective removal operations.
 - 1. Maintain fire-protection facilities in service during selective removal operations.
- G. Although care has been taken to ensure their accuracy, the locations shown for existing partitions, equipment, and structures indicated to be removed, nor their quantity, are guaranteed. It is the Contractor's responsibility to verify these conditions in the field during the bidding process before commencing work. No claims for extra payment due to incorrect locations, dimensions or quantities of items will be considered by the Owner.

1.10 COORDINATION

- A. Arrange selective removal schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Disconnect and cap utilities before starting selective removal operations.

- B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building removal operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective removal activities.
- C. Verify that hazardous materials have been remediated before proceeding with selective removal operations.

3.2 PREPARATION

- A. Refrigerant: Before starting removal, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively removed.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective removal and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - f. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective removal area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective removal of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective removal operations.
 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 5000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being removed.
1. Strengthen or add new supports when required during progress of selective removal.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE REMOVAL, GENERAL

- A. General: Remove existing construction to the extent indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective removal systematically, from higher to lower level. Complete selective removal operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective removal equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 7419 "Construction Waste Management and Disposal."

- B. Site Access and Temporary Controls: Conduct selective removal and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective removal.

3.6 SELECTIVE REMOVAL PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new temporary roofing and so that building interior remains watertight and weathertight.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF REMOVED MATERIALS

- A. Remove waste materials from Project site and recycle or dispose of them according to Section 01 7419 "Construction Waste Management and Disposal."
 - 1. Do not allow removed materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."

- B. Burning: Do not burn removed materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective removal operations. Return adjacent areas to condition existing before selective removal operations began.

END OF SECTION 02 4119

SECTION 028300 – LEAD SAFE WORK PRACTICES

PART 1 - GENERAL

1.1 DESCRIPTION/SCOPE OF WORK

- A. The work covered by these specifications shall consist of furnishing all labor, materials, tools, and equipment necessary to control and mitigate potential lead-based paint (LBP) hazards during demolition/renovation activities pertaining to the ***Ossining UFSD: Ossining HS 3rd Floor Connector Addition.***

The following is a detailed listing of identified Lead-based Paint(s) and/or Lead-containing Material(s), above the EPA action level of 1.0 mg/sq. cm.:

TABLE I: IDENTIFIED LEAD-BASED PAINT OSSINING HIGH SCHOOL CAMPUS (CONSTRUCTION AREAS)				
Location	LBP Component	Substrate	Color	LBP Condition
1 st Floor, Outside Office #10	Wall	Glazed Block	Beige	Fair
1 st Floor, Outside Office #10	Wall Base Trim	Glazed Block	Brown	Fair
2 nd Floor, Passage Corridor	Wall	Glazed Block	Beige	Fair
2 nd Floor, Passage Corridor by Stairwell "D"	Wall	Glazed Block	Beige	Fair
2 nd Floor, Passage Corridor by Stairwell "D"	Wall Base Trim	Glazed Block	Brown	Fair
3 rd Floor Outside Room #319/Elevator	Wall	Glazed Block	Beige	Fair
3 rd Floor Outside Room #319/Elevator	Wall Base Trim	Glazed Block	Brown	Fair
3 rd Floor Room #302 Office	Radiator	Metal	Brown	Fair
It should be noted that several components tested did in fact contain minimal lead-levels below the EPA threshold level of 1.0 mg/sq. cm for classification as Lead-Based Paint (LBP) and are considered lead-containing coatings by the OSHA Regulation, "Lead Exposure in Construction" (29CFR 1926.62). OSHA does not recognize a minimum limit for lead concentration in paint for the purpose of disturbance. Monitoring of workers performing demolition/cleaning/disturbance of painted surfaces shall be completed to document personnel occupational exposure. Items containing any amount of lead concentration are considered lead-containing coatings per 29 CFR 1926.62, OSHA Lead Exposure in Construction.				

The work of this Contractor shall include the following, and shall be as required by specific work-related tasks and disturbance(s) of above-referenced Lead-based Paint(s) and/or Lead-containing Material(s), above the EPA action level of 1.0 mg/sq. cm:

- 1) Personnel air monitoring and analysis.
- 2) Waste characterization and classification.
- 3) Transportation/disposal off-site of LBP wastes/debris and lead-contaminated waste/debris generated from LBP disturbance(s).

- B. Manual demolition, scraping and manual sanding of lead-based paint surfaces and power tool cleaning with dust collection systems shall be performed in conjunction with engineering and work practice controls meeting the requirements of 29 CFR 1926.62(e)(1).
- C. Components with lead-based paint shall be removed intact to the extent practicable. A 6-mil polyethylene drop cloth shall be placed on either side of the component, prior to its removal, to catch any paint chips that may become dislodged. The component shall be wrapped in a layer of 6-mil polyethylene for movement to the disposal container. Follow proper disposal requirements. The area around the component removal shall be wet wiped and HEPA vacuumed, including the tent enclosure. The polyethylene sheeting shall be carefully folded in on itself and placed in a 6-mil disposal bag. Containment debris shall be properly disposed of as lead-based waste.
- D. Chemical stripping should be used for LBP removal on surfaces that will be subjected to welding, cutting or torch burning. No chemical strippers containing methylene chloride shall be used by the Contractor on this project. Abrasive blasting, heat stripping, uncontained hydroblasting, welding, cutting or torch burning shall not be performed on surfaces where LBP is present. Abrasive blasting, heat stripping, uncontained hydroblasting, welding, cutting or torch burning shall only be performed on bare metal substrate.
- E. The Contractor's use of a subcontractor shall not relieve the Contractor of full responsibility for the work to be performed.
- F. If available, the Contractor may submit exposure assessment data obtained within the last twelve (12) months from previous jobs conducted under similar conditions, control methods, work practices and environmental conditions to be used in this contract. Other objective data may be used to demonstrate that work activities in this contract will not result in occupational exposures to airborne lead that exceeds the PEL. The assessment shall include comparable lead concentrations in coating materials, work practices, engineering controls and rates of work.
- G. Until the exposure assessment is performed, the Contractor must provide to his workers the following: Respiratory protection with a minimum protection factor of 10, personal protective clothing, lead-free change areas, hand washing/shower facilities, biological monitoring and training per 29 CFR 1926.62.

This Specification shall be used as a Guideline for the use of Contractors who complete the demolition/renovation activities pertaining to the **Ossining UFSD: Ossining HS 3rd Floor Connector Addition** as detailed within Section #1.2 of this specification. The intent of this Specification is to remain in conformance with 29 CFR 1926.62 and to maintain an airborne concentration of lead-dust below the action level. This Specification is written in order to outline the worst-case scenario in regard to lead safe work practices. However, the work procedures section is written in a manner, which outlines the requirements that should be necessary, at a minimum, to maintain an airborne concentration of lead dust below the action level.

- H. The Contractor shall ensure that any HVAC equipment intakes within and around the work areas are protected by shutting down the units and/or installing HEPA filters over the intake. The Contractor shall coordinate rebalancing of the HVAC equipment prior to installing the HEPA filters. The Contractor shall alter the size and extent of the isolation barriers as necessary due to weather conditions, functional space use and density of building occupants in the vicinity, as required.

1.2 REGULATIONS & REFERENCE STANDARDS

A. General Requirements

All work of this section shall be conducted in strict accordance with all applicable Federal, State and Local regulations.

Matters of interpretations of the standards and regulations shall be submitted to the appropriate agency for resolution before starting work. Where these requirements vary the most stringent shall apply.

B. Specific Requirements

1. American National Standards Institute (ANSI)
 - a. ANSI Z9.2-79 – Fundamentals Governing the Design and Operation of Local Exhaust Systems.
 - b. Z88.2-80 – Practice for Respiratory Protection.
2. Title X - U.S. Department of Housing and Urban Development “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.”
3. Code of Federal Regulations (CFR)
 - a. 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response.
 - b. 29 CFR Part 1910.134 – Respiratory Protection.
 - c. 29 CFR Part 1910.146 – Confined Space Entry Program.
 - d. 29 CFR Part 1910.1025 – Lead.
 - e. 29 CFR Part 1910.1200 – Hazard Communication.
 - f. 29 CFR Part 1926.55 – Gases, Vapors, Fumes, Dusts and Mists.
 - g. 29 CFR Part 1926.57 – Ventilation.
 - h. 29 CFR Part 1926.62 – Lead (Construction Industry Standard).
 - i. 40 CFR Part 260 – Hazardous Waste Management Systems: General.
 - j. 40 CFR Part 261 – Identification and Listing of Hazardous Waste.
 - k. 40 CFR Part 262 – Generators of Hazardous Wastes.
 - l. 40 CFR Part 263 – Transporters of Hazardous Waste.
 - m. 40 CFR Part 264 – Owners and Operators of Hazardous Waste Treatment, Storage & Disposal Facilities.
 - n. 40 CFR Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage & Disposal Facilities.
 - o. 40 CFR Part 268 – Land Disposal Restrictions.

- p. 40 CFR Part 745 – Lead; Requirements for Lead-Based Paint Activities in Child Occupied Facilities
- q. 40 CFR Part 745.90 – EPA’s Renovation, Repair & Painting Rule.
- r. 49 CFR Parts 170-178 – Department of Transportation Regulations.
- 4. New York Codes of Rules and Regulations (NYCRR)
 - a. 6 NYCRR Part 360 – Solid Waste Regulations.
 - b. 6 NYCRR Part 364 – Waste Transporter Permits.
 - c. 6 NYCRR Part 370-373 – Hazardous Waste Regulations.
 - d. 8 NYCRR Part 155 – Uniform Safety Standards for School Construction & Maintenance Projects.
- 5. Steel Structures Painting Council (SSPC)
 - a. SSPC-Guide 6 – Guide for Containing Debris Generated During Paint Removal Operations.

SSPC-Guide 7 – Guide for the Disposal of Lead-Contaminated Surface Preparation Debris.

Preparation Debris.
- 6. Underwriters Laboratories. Inc. (UL)
 - a. UL 586 – High Efficiency, Particulate Air Filter Units.

1.3 DEFINITIONS

- A. Abatement
For the purposes of this Specification, the term abatement shall refer to any procedure that impacts lead-based paint on any surface. Procedures can include: paint removal; whole removal of the surface (i.e. window replacement); demolition of painted surfaces; and clean-up of paint debris.
- B. Action Level
Employee exposure without regard to use of respirators, to an airborne concentration of lead of thirty (30) micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, micrograms per cubic meter of air” refers to the action level. (Note: For longer exposure period lower action level is triggered).
- C. Area Monitoring
Sampling of lead concentrations within the lead control area (work area) and inside the physical boundaries which is representative of the airborne lead concentrations that may reach the breathing zone of personnel potentially exposed to lead.
- D. Physical Boundary
Area physically roped or partitioned off around a work area to limit unauthorized entry of personnel. As used in this section, “inside boundary” shall mean the same as “outside lead control area.”

- E. Change Rooms and Shower Facilities
Rooms within the designated physical boundary around the work area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.
- F. Decontamination Room
Room for removal of contaminated personal protective equipment (PPE).
- G. Eight-Hour Time Weighted Average (TWA)
Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.
- H. High Efficiency Particulate Air (HEPA) Filter Equipment
HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.
- I. Lead Control Area
A work area within which engineering controls are implemented to prevent the spread of lead dust, paint chips or debris from lead-containing paint removal operations. The lead control area is isolated by physical boundaries to prevent entry of unauthorized personnel.
- J. Lead Permissible Exposure Limit (PEL)
Fifty (50) micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR Part 1926.62. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula:
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$
- K. Personal Monitoring
Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR Part 1926.62. Samples shall be representative of the employees work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders with a radius of 6 to 9 inches and the center at the nose or mouth.
- L. Wipe Sampling
Clearance testing procedures, which determine the amount of existing lead-based paint surface dust by atomic absorption spectroscopy analysis, or inductively coupled plasma emission spectrometry expressed in micrograms of lead.

1.4 QUALITY ASSURANCE

- A. Qualifications
 - 1. Contractor: Certification that the Contractor has prior experience on LBP activity projects similar in nature and extent to ensure the capability to perform the required work procedures in a satisfactory manner.
 - 2. Competent Person: Certification that the Contractor's full-time onsite Competent Person meets the competent person requirements of 29 CFR Part 1926.62 and is experienced in administration and supervision of LBP activity projects, including work practices, protective measures for building and personnel, disposal procedures, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course, and have had a minimum of 2 years on-the-job experience.

3. Testing Laboratory: The name, address, and telephone number of the independent testing laboratory selected to perform sampling and analysis for personal and area air samples and wipe samples, and TCLP analysis of LBP wastes and debris. Documentation that the laboratory performing the analysis is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that it is listed proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT), and a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory. Certification shall include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Currently, the American Association for Laboratory Accreditation (ASLA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors. Documentation shall include the date of accreditation or reaccreditation.
 4. Blood Lead Testing Laboratory: The name, address and telephone number of the blood lead testing laboratory; the laboratory's listing by OSHA and the U.S. Public Health Service Center for Disease Control (CDC); and documentation that the laboratory certified in the state where the work site is located.
- B. Respiratory Protection Devices
Manufacturer's certification of NIOSH for respiratory protection devices utilized on the site.
- C. Cartridges, Filters, and Vacuum Systems
Manufacturer's certification of NIOSH approval of respirator cartridges (organic vapor, acid gas, mist, dust, high efficiency particulate); High Efficiency Particulate Air (HEPA) filtration capabilities for all cartridges, filters, and HEPA vacuum systems.
- D. Medical Examination and Records
Certification that employees who are involved in LBP abatement work have received medical examinations and will receive continued medical surveillance, including biological monitoring, as required by 29 CFR Part 1926.62, 29 CFR Part 910.1200, 29 CFR Part 1910.120 and by the state and local regulations pertaining to such work. Records shall be retained, at Contractor expense, in accordance with 29 CFR Part 1910.20.
1. Provide medical surveillance to workers until exposure monitoring reveals that workers are not exposed on any day of the job to airborne lead at or above the Action Level of 30 ug/dL of blood. This consists of a blood test measuring the level of lead and zinc protoporphyrin by a licensed physician. Further testing and medical exams may be necessary depending on the results of initial blood tests and/or the initial exposure assessment.
- E. Training
Training certification shall be provided prior to the start of work involving LBP abatement, for all of the Contractors' workers, supervisors and Competent Person. Training shall meet the requirements of 29 CFR Part 1926.62, 29 CFR Part 1926.59, 29 CFR Part 1910.1200, 29 CFR Part 1910.120 and 49 CFR 172, and that required by EPA or the state LBP course for the work to be performed. Training shall be provided prior to the time of job assignment and, at least, annually. The project specific training shall, at a minimum, include the following.
1. Specific nature of the operation, which could result in exposure to lead.
 2. Purpose, proper selection, fitting, use and limitations of respirators.

3. Purpose and description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant.)
4. Relevant engineering controls and good work practices.
5. The contents of any compliance plan in effect.
6. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
7. The employee's right of access to records under 29 CFR part 1910.20.

F. Respiratory Protection Program

1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 12 months thereafter as required by 29 CFR Part 1910.134 and 29 CFR Part 1926.62.
2. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR Part 1910.134 and 29 CFR Part 1926.62.
3. All workers are required to don an appropriate level of protection commensurate with the airborne concentrations of lead in which they are working. The level of protection will be determined by the Contractor, based on objective air monitoring data.

G. Licenses and Permits

Copies of licenses and permits as required by applicable Federal, state and local regulations shall be obtained before the start of the LBP project.

1.5 SUBMITTALS

- A. The submittals shall be submitted in accordance with Specification Section 01300, Submittals.
- B. **Certifications**
Prior to the start of work, submit required certifications, plans, programs, permits and licenses identified in Paragraph 1.5 of this specification section.
- C. **Equipment List**
Prior to the start of work submit list of equipment items to be used in the work, including brand names, model, capacity, performance characteristics, quantities and other pertinent information.
- D. **Lead-Based Paint (LBP) Management Plan**
The contractor shall prepare a detailed LBP Management Plan that identifies the work procedures, health and safety measures to be used in LBP work procedures; and that addresses spill prevention, containment and emergency response procedures. The plan shall address the methods to be undertaken to abate the lead to include the following key elements:
 1. LBP containment methods to control employee exposure to lead at or below the permissible exposure limit and to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.

2. Training requirements as required by Federal, state and local regulations.
 3. Unique problems associated with the LBP project.
 4. Sketch of location, size and details of LBP control areas, decontamination rooms/areas, change rooms and shower facilities.
 5. Eating, drinking, smoking, and rest room procedures.
 6. Sequencing of LBP related work.
 7. Personnel protective equipment and respiratory protection program, including controls.
 8. Engineering controls, containment structures and safety measures.
 9. Worker exposure assessment procedures.
 10. Work Practice controls.
 11. Housekeeping.
 12. Hygiene facilities and practice.
 13. Medical surveillance, including medical removal procedures.
 14. Sampling, testing and analytical methods to include personnel air sampling requirements of 29 CFR Part 1926.62, wipe sampling of the surface where the LBP was removed and, when required, toxicity characteristic leaching procedure (TCLP) testing of the waste material in accordance with 40 CFR 261 and 6 NYCRR Part 371, and area air sampling required by the specifications. Procedures must include frequency, locations, sampling and analytical methods to be used.
- E. Compliance Program
Contractor's Compliance Program prepared in accordance with 29 CFR Part 1926.62 (e) (2).
- F. Waste Transporter and Disposal Facility Permits, and Disposal Documents.
1. Name, address and telephone number of 6 NYCRR Part 364 transporter who will be transporting the LBP wastes and debris and a copy of the transporter's 6 NYCRR Part 364 permit.
 2. Name, address and telephone number of disposal facility accepting the LBP wastes and debris and a copy of the permit from the disposal facility documenting the facility is permitted to accept the wastes being delivered.
 3. Copy of completed waste characterization (waste profile) forms for obtaining approval to dispose of the LBP wastes and liquid wastes at the disposal facility.
 4. Copy of the approved waste characterization (waste profile) forms from the disposal facility indicating they are permitted to accept the wastes and will accept the wastes being delivered.
 5. Example of completed transportation and disposal documents (i.e., bill of lading or hazardous waste manifest and land disposal restriction notification forms, as applicable) prior to shipment of wastes.

6. Copy of the completed and signed transportation and disposal documents at time of shipment for the disposal of LBP wastes and debris, liquid wastes and any other wastes generated, and copy signed by the disposal facility.
 7. Copy of certificate of destruction for incinerated wastes, certificate of treatment and/or certificate of disposal, as applicable and associated tracking documents from the final disposal facility for disposal of the LBP wastes and debris.
- G. Health and Safety Plan And Confined Space Entry Program
Contractor's written site specific Health and Safety Plan prepared in accordance with 29 CFR Part 1910.120 and Contractor's confined space entry program prepared in accordance with 29 CFR Part 1910.146. These documents are requested for information only and as documentation that they exist.
- H. Sampling and Laboratory Analysis Reports
Submit field sampling logs for all personal and area air samples, wipe samples and waste samples taken, and submit copy of laboratory analysis reports and chain of custody records for all sample analysis.
- I. Competent person certification per Section 3.5.B.

1.6 POSTED WARNINGS & NOTICES

The following regulations, warnings and notices shall be posted at the work site in accordance with 29 CFR Part 1926.62.

- A. Regulations
A copy of applicable Federal, state, and local regulations shall be maintained at the work site.
- B. Warning Signs
Warning signs shall be provided at approaches to LBP control areas. Signs shall be located at a distance from the LBP control areas that will allow personnel to read the sign and take the necessary protective actions required before entering the LBP control area. The signs shall comply with the requirements of 29 CFR Part 1926.62.
- C. Worker Information
Right-to-know notices shall be placed in clearly visible areas of the work site in compliance with Federal, State and Local regulations.
- D. Air Monitoring Results
Daily air monitoring results shall be prepared in order to be easily understood by the workers and shall be placed in a clearly visible area of the work site.
- E. Emergency Telephone Numbers
A list of telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached 24 hours per day and professional consultants directly involved in the project.

1.7 EQUIPMENT & MATERIALS

Sufficient quantities of health and safety materials required by 29 CFR Part 1926.62, and other materials and equipment needed to complete the project, shall be available and kept on the site.

A. Respirators

Air-purifying respirators shall be approved by NIOSH for use with dust, fumes and mists having permissible exposure limits less than 0.05 milligrams per cubic meter (i.e., have high-efficiency particulate air (HEPA) filters) and for other hazardous airborne contaminants that may be encountered, as determined by the Competent Person. The Contractor shall furnish, at no cost to personnel/employee, respirators to provide protection from airborne concentrations of lead. Respirators shall comply with the requirements of 29 CFR Part 1926.62 and shall be used in accordance with 29 CFR Part 1926.62, 29 CFR Part 1926.103 and 29 CFR Part 1910.134.

B. Respirator Cartridges

A sufficient supply of respirator cartridges shall be maintained at the work site to provide new cartridges to employees and authorized visitors, throughout the duration of the project. Cartridges shall be replaced according to the manufacturer's recommendations, when breathing becomes difficult, or if the cartridge becomes wet.

C. Protective Clothing

1. The Contractor shall furnish, at no cost to personnel/employee, equipment/ clothing for protection from airborne and waterborne LBP debris. An adequate supply of these items shall be available for worker and authorized visitor use. Workers and visitors shall not take protective clothing and equipment off the work site at any time. Protective clothing includes:

- a. Coveralls (Whole Body Protective Coverings): Full-body coveralls and head covers shall be worn by workers in the work area as necessary. Sleeves shall be secured at the wrist and pants legs at the ankle with tape. Permeable clothing shall be provided in heat-stress conditions. Where non-disposable coveralls are provided, these coveralls shall be cleaned after each wearing. Cleaning of coveralls and other non-disposable clothing shall be in accordance with the provisions for cleaning in 29 CFR Part 1926.62.
- b. Boots: Work boots with nonskid soles or impermeable work boot covers shall be worn by workers. Where required by OSHA, safety boots (steel toe or steel toe and shank) shall be worn. Paint the uppers of boots red with waterproof enamel. Do not allow boots to be removed from the work area for any reason after being contaminated with LBP debris. Dispose of boots as LBP contaminated waste at the end of the work.
- c. Gloves: Inner gloves, appropriate for items and hazards encountered and disposable outer work gloves shall be provided to each worker and shall be worn while the worker is in the work area. Glove material shall be appropriate for the specific chemical exposure. Gloves shall not be removed from the work area and shall be disposed of as LBP contaminated waste at the end of the work.
- d. Hard Hats: Head protection (hard hats) shall be provided as required by OSHA for workers and authorized visitors. Protective plastic-strap suspension hats shall be used. Hard hats shall be worn at all times that work is in progress. Hats shall remain in the work area until the project is completed. Hats shall be thoroughly cleaned, decontaminated and bagged before being removed from the work area at the end of the project.

- e. Eye Protection: Fog-proof goggles for personnel engaged in LBP operations shall be worn when the use of a full-face piece respirator is not required.

D. Negative Air Pressure System

When a LBP control area requires the use of an airtight containment barrier, a negative air pressure system shall be used and pressure differential recordings taken. LBP shall not be removed from the LBP control area until the proper engineer controls and HEPA filtration systems are in place.

1. HEPA Filter Requirements

The negative air pressure system shall be equipped with approved HEPA filters per UL 586. Negative air pressure equipment shall be equipped with new HEPA filters, and shall be sufficient to maintain a minimum pressure differential of minus 5 Pa (0.02 inch) of water column relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed below.

- a. The unit shall be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.
- b. The HEPA filter shall be certified as being capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
- c. The unit shall be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures 620 Pa (2.5 inches of water) static pressure differential on a magnehelic gauge.
- d. The unit shall be equipped with a manometer-type negative pressure differential monitor with minor scale division of 0.02 inch of water and accuracy within plus or minus 1.0 percent. The manometer shall be calibrated daily as recommended by the manufacturer. Record manually manometer readings of the pressure differential between the LBP control area and adjacent unsealed areas at the beginning of each workday and every 2 working hours thereafter.
- e. The unit shall be equipped with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.
- f. The unit shall be equipped with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.
- g. The unit shall be equipped with an audible horn that sounds an alarm when the machine has shut itself off.
- h. The unit shall be equipped with an automatic safety mechanism that prevents a worker from improperly inserting the main HEPA filter.
- i. The unit shall be ducted through the containment barrier wall to the outside of the work area. The unit shall not be exhausted into any work area.

2. Number of Units Required

The air within the containment barrier shall be changed at least once every 15 minutes by a continuously operating negative air pressure system, until the LBP control area barrier is removed. Filters shall be replaced as necessary to maintain the efficiency of the system. A back-up unit shall be maintained onsite.

3. **Auxiliary Generator**
An auxiliary generator shall be provided with a capacity adequate to power a minimum of 50 percent of the negative air machines at any time during the work. When power fails, the generator controls shall automatically start the generator and switch the negative air machine to generator power. The generator shall not present a carbon monoxide hazard to workers.
 4. **Discontinuing Negative Air Pressure System**
The negative air pressure system shall not be shut down during LBP work unless authorized by the Owner's Consultant. At the completion of the LBP work procedures and disposal project, units shall be run until full cleanup has been completed and wipe clearance samples have been collected, analyzed and have passed final clearance testing requirements. Dismantling of the negative air pressure systems shall conform to the written decontamination procedures. Prefilters shall be removed and properly disposed. The intake to the machines shall be sealed with polyethylene to prevent environmental contamination.
- E. **Expendable Supplies**
1. **Polyethylene Sheet and Bags - General**
Polyethylene sheet and bags shall be minimum 6-mil thick. Bags shall have pre-printed labels, and 5-inch (minimum) long plastic ties, pointed and looped to secure the filled bags. Polyethylene sheets shall be in roll sizes to minimize seams.
 2. **Polyethylene Sheet - Flame Resistant**
Where a potential for fire exists, flame-resistant polyethylene sheets shall be provided. Polyethylene film shall conform to the requirements of NFPA 701.
 3. **Polyethylene Sheet - Reinforced**
Reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the LBP control area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.
 4. **Tape and Adhesive Spray**
Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 2 inches wide, industrial strength.
 5. **Containers**
DOT approved impermeable containers shall be used to receive and retain LBP waste and debris, and lead contaminated material until disposal. Containers shall be labeled in accordance with EPA, DOT and OSHA standards.
 6. **Chemicals**
Chemicals, including caustics and paint strippers, shall be properly labeled and stored in leak-tight containers.
- F. **Vacuum Systems**
HEPA filtered vacuum systems shall be used during LBP operations which generate dust. The systems shall be suitably sized for the project, and filters shall be capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.

- G. Heat Blower Guns
Heat blower guns shall be flameless, electrical, paint-softener type with controls to limit temperature to 590 degrees C (1,100 degrees F). Heat blower shall be DI (non-grounded) 120 Vac, and shall be equipped with cone, fan, glass protector and spoon reflector nozzles.
- H. Chemical Paint Strippers
Chemical paint strippers shall contain no methylene chloride.
- I. Chemical Paint Stripper Neutralizer
Neutralizers for paint strippers shall be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

1.8 STORAGE OF MATERIALS

Materials shall be stored in a place and manner, which protects them from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. Regularly inspect materials to identify damaged or deteriorating items. Damaged or deteriorated items shall not be used and shall be removed from the site as soon as they are discovered. Stored materials shall not present a hazard or an inconvenience to workers, visitors and/or other employees.

PART 2 – PRODUCTS

(NOT APPLICABLE)

PART 3 – EXECUTION

3.1 WORK PROCEDURES

LBP work procedures and related work shall be performed in accordance with the U.S. Department of Housing and Urban Development “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing” and the accepted Contractor’s LBP Management Plan. Procedures and equipment required to limit occupational and environmental exposures to lead during LBP removal shall be in accordance with 29 CFR Part 1926.62 and as specified herein. LBP waste and debris, lead contaminated debris and personal protective clothing and equipment shall be disposed of in compliance with Federal, state, and local regulations.

- A. Personnel Protection Procedures
Personnel shall wear and use protective clothing and equipment as specified and required by 29 CFR Part 1926.62 and 29 CFR Part 1910.120. Eating, smoking, drinking, chewing tobacco and chewing gum, and applying makeup shall not be permitted in the LBP control area. Personnel of trades not engaged in the LBP work procedures and disposal of LBP shall not be exposed at any time to airborne concentrations of lead equal to or in excess of 30 micrograms per cubic meter of air. Electrical service shall be disconnected when wet removal is performed, and temporary electrical service protected by a ground fault circuit interrupter shall be provided.
- B. Safety and Health Procedures
The Competent Person shall be present on the work site throughout the LBP project to supervise, monitor and document the project’s health and safety provisions. A daily log shall be maintained showing the results of sampling tests throughout the project area. LBP work being conducted within a LBP Control area where an airtight barrier is required shall be stopped if measured airborne lead concentrations, collected during LBP work procedures, exceed the pre- LBP work procedures airborne concentration levels.

C. Safety and Health Responsibilities

The Competent Person shall:

1. Verify that training meets applicable requirements.
2. Review and approve LBP Management Plan for conformance to the applicable referenced standards.
3. Inspect LBP removal work for conformance with the accepted LBP Management Plan.
4. Ensure that worker exposure air monitoring activities are in accordance with 29 CFR Part 1926.62.
5. Ensure work is performed in strict accordance with specifications.
6. Ensure hazardous exposure to personnel and to the environment are adequately controlled.
7. The Contractor's Competent Person shall be responsible for directing personal air monitoring.
8. The Owner's Consultant shall be responsible for directing area and final air/wipe testing.

D. Medical Surveillance Procedures

Medical surveillance shall be implemented in accordance with the accepted Contractor's LBP Management Plan, and shall comply with the requirements of 29 CFR Part 1926.62, including the provisions for biological monitoring, medical removal, protection and a physician's written opinion, signed by the physician performing the employee examination. The Contractor shall provide a copy of the written opinion for Contractor's employees prior to each employee's commencement of work.

E. Engineering Controls and Containment Structures

Engineering and work practice controls are the primary means of maintaining exposures to lead below the PEL. Paint removal and surface preparation activities must keep dust levels at a minimum. Torch cutting of surfaces with LBP will require appropriate personal protective equipment and exposure controls. Power tools must be equipped with vacuum shrouds including a high efficiency particulate air filtered vacuum system attached.

1. LBP Control Area

The LBP control area is where LBP work procedures occur and as such shall be considered contaminated. The LBP control area shall be isolated to prevent LBP containing dust or debris from passing into adjacent open areas. The control area shall be decontaminated at the completion of the LBP work procedure and disposal work.

2. Boundary Requirements.

Physical boundaries shall be provided around exterior LBP control areas by roping off the area indicated in the LBP Management Plan.

3. Control Barriers

The LBP control area shall be designated and separated from other outside areas with control barriers. The polyethylene sheeting shall have all openings masked and sealed. The LBP control area shall be erected according to the Contractors LBP Management Plan. Polyethylene sheeting shall be mechanically supported, independent of duct tape or spray adhesive.

4. **Masking and Sealing**
 - a. Exterior LBP control area requirements: Where the construction of a contained LBP control area is impractical or not required based on the method of lead work procedures, a roped-off perimeter shall be installed 20 feet from and around the area where the LBP handling procedures are performed and other requirements for LBP control areas shall be maintained. Personal monitoring of airborne concentrations shall be conducted in adjacent areas during the work shift, in accordance with 29 CFR Part 1926.62. Area air monitoring inside and outside of the roped-off perimeter shall be conducted as specified. Airborne concentrations shall not exceed specified levels.
5. **Personnel Decontamination Unit**

Personnel decontamination units shall be provided when required for the LBP procedures. Materials fabricated or delivered to the site before the shop drawings have been returned to the Contractor will be subject to rejection by the Owner's Consultant. Specifications and drawings of portable prefab units, such as a trailer unit, if utilized, must be submitted for review and approval before start of construction. Submittal shall include, but not be limited to, a floor plan layout showing dimensions, materials, sizes, thickness, plumbing, and electrical outlets. Access between contaminated and uncontaminated areas shall be through an airlock. Access between any two rooms or room and trailer within the decontamination unit shall be through a plastic sheeting curtained doorway. A separate equipment decontamination unit shall be provided. Each work area shall have an emergency exit. The personnel decontamination unit's clean room shall be the only means of entrance and exit, except for emergencies, from the LBP control area. Materials shall exit the LBP control area through the equipment decontamination area.
6. **Clean Room**

The clean room shall have only one exit to non-contaminated areas of the site. An airtight seal shall be constructed of polyethylene between the clean room and uncontaminated areas. Surfaces of the clean room shall be protected with sheet polyethylene. A temporary unit with a separate equipment decontamination locker room and a clean locker room shall be provided for personnel who are required to wear whole body protective clothing. One locker shall be provided in each locker room for each LBP worker, and each Contractor's representative. Lead-free personal clothing and shoes shall be kept in the clean locker. Hand wash station/showers shall be located between the equipment decontamination locker room and the clean locker room, and employees shall wash or shower before changing into personal clothes. An adequate supply of clean disposable towels shall be provided. LBP contaminated work clothing shall be cleaned. Clean rooms shall be physically attached to the LBP control area for areas inside the building but may be directly adjacent to the LBP control area outside of the building. Joint use of this space for other functions, such as offices, equipment storage, etc., is prohibited.
7. **Hand Wash Station/Shower Room**

An operational shower and hand washing station shall be provided between the work area and the clean changing room. Workers shall wash and/or shower before entering the clean changing room. Shower room shall be separated from other rooms by air-tight walls fabricated from polyethylene sheeting. Water shall be hot and cold or warm. Shower heads/ controls, soap dish, continuing supply of soap, and clean towels shall be provided. The shower shall be maintained in a sanitary condition. Waste water shall be pumped to drain and through waste water filters that meet state and/or local requirements. These filters shall be located inside the shower unit and filters shall be changed regularly. Spent filters shall be discarded as LBP contaminated waste.

8. **Equipment Decontamination**
The Equipment Decontamination Unit shall be used for removal of equipment and materials from the LBP control area, and shall include a wash room, holding room, and an enclosed walkway. The unit shall be constructed from wood framing material and polyethylene sheeting. Workers shall not enter or exit the LBP control area through the Equipment Decontamination Unit. A washdown station, consisting of an enclosed shower unit, shall be located in the work area outside the Wash Room. The washdown station shall be used to clean equipment, bags and containers. Bagged or containerized LBP wastes shall be passed from the work area and cleaned in the Wash Room. The Wash Room shall be separated from the work area by a polyethylene sheet flap. Wastewater shall be filtered and filters shall be changed as required for the shower unit and the Wash Room. Filters shall be disposed of as LBP contaminated wastes. The Holding Room shall be used as a drop location for bagged LBP passed from the Wash Room. This room shall be constructed so that bagged materials cannot be passed from the Wash Room through the Holding Room to the enclosed walkway. The walkway shall provide access to the Holding Room from outside the work area. The enclosed walkway shall be separated from the exterior by a single flap of polyethylene sheeting. The Contractor's equipment used for LBP work procedures shall be decontaminated prior to its removal outside of the lead control area. The decontamination water shall be containerized, the containers labeled, the liquid sampled and analyzed in the laboratory for lead, and properly disposed of off-site according to applicable Federal, State and Local regulations. See Paragraph 3.5.C.2.
9. **Maintenance of Decontamination Units**
Barriers and polyethylene sheeting shall be effectively sealed and taped. Containment barriers shall be visually inspected at the beginning of each work period. Damaged barriers and defects shall be immediately repaired upon discovery. Smoke testing methods shall be used to test effectiveness of barriers when directed by the Owner's Consultant.
10. **LBP Control Area Exiting Procedures**
Personnel exiting a LBP control area shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:
 - a. HEPA vacuum all protective clothing before removing.
 - b. Remove protective clothing in the decontamination room and place this clothing in an approved impermeable disposal bag.
 - c. Wash or shower.
 - d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated work site.

F. **Temporary Utilities**

1. Temporary equipment as necessary to provide adequate power, light, heat, and water shall be installed, as needed, to accomplish the LBP operations properly and safely. The Contractor shall maintain the security and maintenance of the utility system in the LBP control areas. In the event of a failure of any utility system, the Owner will not be responsible for any loss of time or other expense incurred by the Contractor. In addition to any site-specific temporary utility requirements, the Contractor shall provide:
 - a. Back-flow protection on all water connections is required. Fittings installed by the Contractor shall be removed after completion of work with no damage or alteration to existing water piping and equipment.

- b. When applicable, heavy-duty abrasion-resistant hoses to provide water to each work area and decontamination area.
- c. A hot water heater, if necessary, to provide warm water to the decontamination showers.
- d. Electrical service to work areas. Electrical service shall comply with National Electric Code, State and Local requirements and UL standards. Warning signs shall be posted at power outlets, which are other than 110-120 volt power. Only grounded extension cords shall be used. Incandescent lamps and light fixtures shall be of adequate wattage to provide good illumination in LBP control areas.
- e. Temporary heating units, when needed, that have been tested and labeled by UL, FM, or another recognized trade association related to the fuel being consumed. Forced air or fan type units shall not be utilized inside a work area. Units shall have tip-over protection.
- f. Sufficient quantity of single-occupant, self-contained chemical toilets, properly vented and fully enclosed.

3.2 LEAD-BASED PAINT WORK PRACTICES (Use methods as applicable)

A. Component Removal:

Components shall be removed intact to the extent practicable. A 6-mil polyethylene drop cloth shall be placed on either side of the component, prior to its removal, to catch any paint chips that may become dislodged. The component shall be wrapped in a layer of 6-mil polyethylene for movement to the disposal container. Follow proper disposal requirements. The area around the component removal shall be wet wiped and HEPA vacuumed, including the tent enclosure. The polyethylene sheeting shall be carefully folded in on itself and placed in a 6-mil disposal bag. Containment debris shall be properly disposed of as lead-based waste.

Clearance will be performed as follows:

1. Visual Clearance - Determine that all required work has been completed. Look for settled dust, paint chips or debris in work area. If located, cleanings will commence until visual inspection locates no evidence of dust.
2. The Owner's Consultant shall perform Dust and/or Soil Sampling as outlined in the U.S. Department of Housing and Urban Development "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing".

B. Chemical Stripping: Assumed Exposure (50 ug/m³ - 500 ug/m³)

Chemical stripping, using an agent approved by the Owner's Consultant, followed by wet scraping is the preferred method of abatement for areas where torch cutting, welding and/or other hot-work will affect building components coated with lead-based paint or lead containing coatings. The specific stripping agent(s) proposed must be approved by the Owner. No chemical strippers containing methylene chloride shall be used by the Contractor on this project.

1. Horizontal surfaces directly below and at least 10' in a radial direction from the area where chemical stripping is to be performed shall be protected with 6-mil poly.

2. All LBP on specified surfaces shall be removed to the bare substrate. The job is not considered complete until the substrate is dry and free of paint, debris, and LBP residue.
 3. LBP stripping agents shall be brushed or troweled on the designated surfaces, or otherwise applied in accordance with manufacturer's specifications. The minimum thickness of chemical stripping agent applied shall be 0.125 (1/8) inches or the manufacturer's recommendations.
 4. Stripping agents shall not be applied to, nor be allowed to inadvertently penetrate, wood and/or other porous substrates.
 5. The required dwell time for stripping will depend upon the ambient temperature, humidity, and thickness of LBP. If LBP is not completely removed following the initial application of stripper, a second application and wet scraping may be required.
 6. Removed LBP shall not be deposited on the polyethylene containment surfaces, but shall be transferred directly into 6-mil polyethylene bags from the scraper. LBP shall be removed by wet scraping to the maximum extent feasible.
 7. Any residue not removable by wet scraping shall be washed down to the bare metal substrate with a high-phosphate solution. LBP-contaminated wastewater shall be kept to a minimum using wet scrub brushes or sponges. These residues and disposable cleaning media shall also be directly transferred to the 6-mil polyethylene bags containing other LBP wastes. Free standing water shall be eliminated by use of a drying agent.
 8. Clearance will be performed as follows:
 - a. Visual Clearance - Determine that all required work has been completed. Look for settled dust, paint chips or debris in work area. If located, cleanings will commence until visual inspection locates no evidence of dust.
 - b. The Owner's Consultant shall perform Dust and/or Soil Sampling as outlined in the U.S. Department of Housing and Urban Development "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing".
- C. Manual Demolition/Scraping/Cleaning: Assumed Exposure (50 ug/m³ - 500 ug/m³)
- Manual demolition, scraping, manual sanding and power tool cleaning with dust collection systems shall be performed in conjunction with engineering and work practice controls meeting the requirements of 29 CFR 1926.62(e)(1).
- Seal openings of HVAC ductwork and other penetrations (doors, windows, etc.) within the Control Area with two layers of 6-mil polyethylene sheeting. For work on vertical surfaces, place a layer of 6-mil polyethylene sheeting below the area prior to manual demolition/scraping/ cleaning. The sheeting shall extend 5 ft. on either side of the work area, to catch any paint chips that may become dislodged.

Wet methods shall be used during manual scraping, manual sanding and power tool cleaning with dust collection systems. Local HEPA ventilation shall be utilized in conjunction with manual scraping, manual sanding and power tool cleaning with dust collection systems. In the case that local HEPA ventilation is not sufficient to control dust hazards, the Contractor shall be required to install engineering controls to meet requirements of Specification Section 1.8(D) "Negative Air Pressure System".

Removed LBP shall not be allowed to accumulate on surfaces within the Control Area, but shall be HEPA vacuumed or placed directly into 6-mil polyethylene bags. The Contractor shall maintain all surfaces as free as practicable of accumulated lead dust to prevent the dispersal of lead into the work place. LBP shall be removed by manual methods to the maximum extent feasible.

Debris shall be bagged in 6-mil polyethylene bags and secured in leak proof drums until TCLP testing is completed. Follow proper disposal requirements. The area around the surfaces subject to work shall be wet wiped and HEPA vacuumed, including the polyethylene sheeting. Upon clearance by the Owner's Consultant, the polyethylene sheeting shall be carefully folded in on itself and placed in a 6mil disposal bag. Containment debris shall be properly disposed of as lead-based waste.

Clearance will be performed as follows and as needed:

- a. Visual Clearance – determine that all required work has been completed. Look for settled dust, paint chips or debris in work area. If located, cleanings will commence until visual inspection locates no evidence of dust.
- b. The Owner's Consultant shall perform Dust and/or Soil Sampling as outlined in the U.S. Department of Housing and Urban Development "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing".

D. Alternative Lead Work Procedures

1. Any Work Procedure other than the outline procedures above, shall be submitted to the Owner's Consultant for approval prior to the start of the project. As there are many different components in differing areas of the building(s), it is impractical to address every potential lead work procedure. The intent of alternative lead work procedures shall be to maintain compliance with 29 CFR 1926.62 and maintain airborne concentrations of lead dust below the Action Level of 30 ug/dL of air.

3.3 MONITORING & CLEARANCE SAMPLING

During the entire LBP removal and disposal operations, the Owner's Consultant shall be on-site directing the monitoring/sampling and inspecting the work to ensure that the health and safety requirements of this contract are satisfied.

A. Personnel Air Monitoring (Provided by the Contractor, as necessary)

1. Personnel air monitoring samples for airborne concentrations of lead shall be collected and analyzed in accordance with 29 CFR Part 1926.62. Results shall be reported in micrograms per cubic meter of air. The Competent Person shall use personal air monitoring results to determine the effectiveness of engineering controls, the adequacy of PPE and to determine if proper work practices are being employed. The Owner's Consultant shall be notified if any personal air monitoring result equals or exceeds 30 micrograms per cubic meter of air. The Contractor shall take steps to reduce the concentration of lead in the air.

- B. Area Air Monitoring (Provided by the Owner's Consultant, as requested)
Airborne concentrations of lead shall be collected and analyzed in the laboratory. Results shall be reported in micrograms per cubic meter of air.
1. Pre-LBP work
Pre- LBP work samples shall be collected in the following locations: 1) inside the lead control area, one upwind of the LBP work and two downwind of the LBP work procedure activities; and 2) outside the physical boundary (roped off) area, one upwind of the LBP work and two downwind of the LBP work activities. A total of six (6) samples. If work is performed inside the building, similar numbers of samples are to be positioned inside and outside the LBP containment area.
 2. LBP Work
The Competent Person shall collect area air samples on a daily basis during the duration of the LBP work. The samples shall be collected in the same location as the pre-work samples.
 3. The area air samples shall be collected at 4 to 6 feet above grade, and using high volume air samplers.
 4. The air samples shall be analyzed by NIOSH Method 7082 or method approved by Engineer.
 5. Results
The Contractor shall have the results of the area air monitoring within 24 hours after completion of the sampling. Results shall be reported in micrograms per cubic meter of air.
 6. Excessive Levels
Outdoor LBP work shall cease and the Owner's Consultant notified if measured airborne lead concentrations, collected during LBP activities, exceed the pre-work airborne concentration levels. The Contractor may be required to clean and re-sample the affected area, at no additional cost to the Owner, if directed by the Owner's Consultant. The Contractor shall correct the work practices and/or engineering controls and shall resume LBP work procedures at the direction of the Owner's Consultant.
- C. Waste Sampling and Testing (Provided by the Contractor)
Sampling and testing of all waste, shall be in accordance with 40 CFR Part 261, 6 NYCRR Part 371 and SW-846, Chapter 9, Sampling Plan. See Paragraph 3.5.C of this specification section for waste sampling and analyses requirements.
- D. Soil Sampling (Provided by the Owner, as requested)
1. If the Owner's Consultant or Owner's representative observes paint chips or LBP debris on the surface of the soil surrounding the work area during the LBP work procedures or at completion or if the Owner's Consultant or IH/ Owner's Representative suspects potential contamination to the soil based on observed procedures and conditions during the work, the contractor shall pay for composite soil samples of the surface soil where designated by the Owner's Consultant and at a frequency specified by the Owner's Consultant. Two Background surface soil samples will be collected where directed by the Owner's Consultant. The samples shall be analyzed by an independent laboratory for lead on a total basis (by EPA Method 6010) and TCLP basis (Extraction Method 1311, analysis by EPA Method 6010).

2. Standard Soils Clearance samples shall be collected by the Owner's Consultant and paid for by the Owner. The samples shall be analyzed by an independent laboratory for lead on a total basis (by EPA Method 6010) and TCLP basis (Extraction Method 1311, analysis by EPA Method 6010).
3. If the analyses exceed the TCLP limit, the soil shall be treated as LBP contaminated waste, excavated and disposed of as a hazardous waste by the Contractor.

Clearance Level:

Soil: 400 microgram per gram

E. Dust/Wipe Sampling (Provided by the Owner, as necessary)

1. Dust/wipe samples shall be taken no sooner than 24 hours after abatement activities, including clean-up activities, have been completed.
2. Sampling for clearance criteria shall be performed as detailed in the HUD Guidance document. Appendices 13 and 14.
3. Failure to clear the work area and recleaning shall be the responsibility of the Contractor. The work area shall remain in place until satisfactory clearance has been achieved.
4. Analysis of Dust/Wipe samples for areas, which failed previous Dust/Wipe sampling, shall be reimbursed by the Contractor.

Clearance Levels:

Floors: 10 micrograms per square foot

Window Sills: 100 micrograms per square foot

Window Wells: 400 micrograms per square foot

3.4 ADJACENT AREAS

Damage to adjacent areas shall be repaired to the approval of the Owner.

3.5 CLEAN-UP & DISPOSAL

A. Cleanup

1. **Daily**
Surfaces in the LBP control area shall be maintained free of accumulations of paint chips, LBP debris, blasting debris and dust. Spread of dust and debris shall be restricted; waste shall not be distributed over the work area. Dry sweep or compressed air shall not be used for cleanup. At the end of each shift, the area shall be cleaned of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet wiping the area. LBP work procedures work shall cease during the cleanup.
2. At Completion of LBP work Procedure and a satisfactory visual inspection by the Engineer, a clean-up shall be performed by the Contractor. This clean-up includes removal of any contaminated material, equipment or debris including polyethylene sheeting from the work area. The polyethylene sheeting shall be sprayed or misted with water for dust control, construction debris removed and then the sheeting removed by folding it in upon itself.

- a. Lead-contaminated debris shall be containerized in accordance with paragraph 3.5.C.1, LBP Wastes and Lead-Contaminated Wastes. Waste bags shall not be overloaded, shall be securely sealed and stored in the designated area until disposal.
- b. Removal of surface polyethylene sheeting shall begin from top to bottom. Removal of floor polyethylene sheeting shall begin at the corners and folded in the middle to contain the dust. Polyethylene shall be disposed of as specified in Paragraph 3.5.C.1
- c. Cleaning Equipment. The Contractor shall decontaminate the lead abatement equipment and equipment used in the work area. The wastewater from cleaning shall be contained, sampled and disposed of as specified in Paragraph 3.5.C.2.

B. Certification

The Contractor shall certify in writing that the inside and outside the lead control area air monitoring samples are less than 30 micrograms per cubic meter of air, the respiratory protection for the employees was adequate, the work procedures were performed in accordance with 29 CFR Part 1926.62 and that there was no visible accumulations of lead-based paint and dust on the worksite. Do not remove warning signs at the lead control area or roped-off boundary signs prior to the Owner's Consultant's receipt of the Contractor's certification. Re-clean areas showing dust, residual paint chips. LBP debris and blasting debris.

Waste Storage, Sampling/Analysis and Disposal (Provided by the Contractor)

1. LBP Wastes and Lead-Contaminated Water

LBP waste, and lead-contaminated waste and debris shall be stored sampled and analyzed and disposed of as follows.

- a. The LBP waste and debris, lead contaminated personal protective equipment (PPE), clothing and waste polyethylene and lead-contaminated waste and debris shall be containerized in DOT approved containers (i.e.. 55 gallon drums, roll-off, etc.). If the waste is placed in roll-off(s), the roll off shall be lined with a minimum of 2 layers of 6-mil polyethylene prior to placing any waste in it and covered with a liquid tight cover. Each container shall be labeled to identify the type of waste as defined in 49 CFR Part 172, 6 NYCRR Part 371 and 6 NYCRR Part 360 and with the date lead contaminated wastes were first put into the container.
- b. A representative sample of the container(s) of LBP wastes and lead-contaminated wastes and debris generated by the LBP activities shall be taken in accordance with SW-846, Chapter 9, Sampling Plan and analyzed in the laboratory for TCLP lead by EPA Methods 1311 (extraction) and 6010 (analysis). If the wastes are placed in roll-off(s), four (4) composite samples per roll-off shall be taken for analysis. If the wastes are placed in 55 gallon drums, one composite sample for every ten (10) drums of wastes shall be taken for analysis. The laboratory analyses results shall dictate the proper method of disposal of the waste. A copy of the results shall be attached to the waste characterization (waste profile) form.

- c. A waste characterization (waste profile) form shall be completed for the LBP waste and lead-contaminated waste and debris, and lead contaminated personal protective equipment and clothing (if containerized separately) and the forms submitted to Owner's Consultant for approval. The Owner shall sign the forms. The Contractor shall process the forms and forward to the disposal facility for approval. The approved waste profile forms from the disposal facility shall be submitted to the Owner and Engineer prior to shipment of the wastes off-site.
- d. The applicable waste transportation and disposal documents (i.e., hazardous waste manifest, bill of lading, non-hazardous waste manifest, land disposal restriction notification, etc.) shall be obtained and completed. An example of the completed waste transportation and disposal documents shall be submitted to Owner's Consultant for approval prior to shipment of the waste off-site.
- e. Pick-up of hazardous wastes shall be made as needed to ensure that containers do not remain on the work site longer than 90 calendar days from the date affixed to each container. The Owner will assign an area for interim storage of waste-containing containers.
- f. Lead contaminated personal protective equipment/ clothing, lead contaminated polyethylene, filters and debris, which cannot be sampled, shall be handled, stored, transported, and disposed of in the same manner as the LBP wastes and lead-contaminated wastes and debris, based on the sampling, laboratory analyses results and SW-846, Chapter 9, Sampling Plan calculations performed on the LBP wastes and lead-contaminated wastes and debris.
- g. The LBP and lead contaminated wastes/ debris shall be handled, stored, transported and disposed of in accordance with 40 CFR Parts 260 to 265, 6 NYCRR Part 370 to 373, 6 NYCRR Part 364 and 6 NYCRR Part 360, as applicable. Additionally, the disposal shall be based on the sampling, laboratory analysis results and SW-846, Chapter 9, Sampling Plan calculations. Land disposal restriction notification shall be as required by 40 CFR Part 268 and 6 NYCRR Part 376.

2. Wastewater and Decontamination Water

- a. Lead contaminated wastewater and decontamination water generated from the LBP work procedures shall be stored in DOT approved 55 gallon drums. Each drum shall be labeled to identify the type of waste as defined by 49 CFR Part 172, 6 NYCRR Part 371 and 6 NYCRR Part 360 and with the date lead contaminated liquid was first put into the drum.
- b. A representative sample from the drum(s) of liquid wastes shall be taken in accordance with SW-846, Chapter 9, Sampling Plan and analyzed in the laboratory for total lead and total cadmium by EPA Method 200.7/6010. One composite sample for every ten (10) drums of liquid wastes shall be taken for analysis. The laboratory analyses results shall dictate the proper method of disposal of the waste. A copy of the results shall be attached to the waste characterization (waste profile) form.
- c. A waste characterization (waste profile) form shall be completed for the liquid wastes and other wastes being generated and submitted to Owner's Consultant for approval. The Owner shall sign the form(s). The Contractor shall process the form(s) and forward the forms to the disposal facility for approval. The approved waste profile form(s) from the disposal facility shall be submitted to the Owner and Engineer prior to shipment of the wastes off-site.

- d. The applicable waste transportation and disposal documents (i.e., hazardous waste manifest, bill of lading, non-hazardous waste manifest, land disposal restriction notification, etc.) shall be obtained and completed. An example of the completed waste transportation and disposal documents shall be submitted to Owner's Consultant for approval prior to shipment of the waste off-site.
- e. The lead contaminated wastewater and decontamination water shall be handled, stored, transported and disposed of in accordance with 40 CFR Parts 260 to 265, 6 NYCRR Part 370 to 373, 6 NYCRR Part 364 and 6 NYCRR Part 360 as applicable.

3. Waste Pick-Up and Disposal

- a. Waste pick-up cannot be performed until all required submittals have been reviewed and approved by the Owner's Consultant. The Owner must be present at waste pick-up to sign the waste transportation documents and approve pick-up. No waste shall leave the site without approval and authorization by Owner.
- b. Coordinate scheduling of waste pick-up and transportation with Owner's Consultant. Notify Engineer at least 48 hours ahead of when the waste pick-up will take place.
- c. All wastes shall be properly disposed of off-site at an approved disposal facility. The wastes shall be transported by a transporter permitted to transport wastes per 6 NYCRR Part 364. The wastes shall be disposed of at a facility permitted to accept the waste being disposed of.
- d. Submit copy of completed and signed transportation and disposal documents to Owner and Engineer at time of shipment and submit copy of document signed by the disposal facility.
- e. Return or cause to be returned all waste manifests and bills of lading signed by the disposal facility within fifteen (15) days of removal from the project site.
- f. Submit certification of destruction for all incinerated wastes and certificates of final treatment and/or final disposal, as applicable, for all wastes disposed of off-site.
- g. All waste transportation and disposal must be conducted in accordance with all applicable State, Local and Federal regulations, all generator State regulations, all the State regulations where the wastes are transported through, and the disposal State regulations.

C. Payment for Disposal of Wastes

Payment for disposal of wastes will not be made until the following are received by the Owner:

- 1. A signed copy of the manifests
- 2. Bills of lading
- 3. Weight tickets, etc.
- 4. Certificate of final disposal, from the final treatment or disposal facility certifying the amount of lead containing wastes and debris delivered.

PART 4 – INSPECTION

4.1 SUMMARY OF INSPECTION

Limited lead-based paint inspections were completed throughout specific Renovation Areas as detailed on CPL architectural drawings to identify suspect lead-based paints and/or lead-containing hazards potentially affected by scheduled demolition/renovation activities included within the ***Ossining UFSD – Ossining HS 3rd Floor Connector Addition***, as detailed within Section #1.2 of this specification.

Inspection was completed by Niton-certified XRF Technician & EPA Lead Risk Assessor Mr. Louis N. Johnson III of **QuES&T**, on December 9th of the year 2020. Existing documentation and/or information attained within prior inspections and/or sampling activities were reviewed and incorporated into this specification.

Paint testing was completed on-site utilizing a Niton XLp-300A XRF Spectrum Analyzer Serial # 102273 in accordance with the EPA issued Performance Characteristics Sheet (PCS). A summary of results above the EPA action level of 1.0 mg/sq. cm., has been included in order to aid prospective bidders.

Survey was completed in accordance with EPA, OSHA and/or HUD Guidelines for inspection of lead-based paint(s) and/or lead-containing material(s). Per these protocols, all suspect coated surfaces impacted by demolition/renovation activities were located and categorized by homogeneous painting histories and component types.

4.2 SUMMARY OF RESULTS ABOVE THE EPA ACTION LEVEL OF 1.0 mg/cm²

The following is a detailed listing of identified Lead-based Paint(s) and/or Lead-containing Materials, above the EPA action level of 1.0 mg/sq. cm. The following listing should be utilized as a guide to specific work-related tasks and is not necessarily an Abatement Scope. Specified lead-safe work practices shall be performed in accordance with the stipulations defined within this specification as required by specific work-related tasks and in advance of disturbance(s) of the following Lead-based Paint(s) and/or Lead-containing Material(s), above the EPA action level of 1.0 mg/sq. cm:

<u>TABLE I: IDENTIFIED LEAD-BASED PAINT</u> <u>OSSINING HIGH SCHOOL CAMPUS (CONSTRUCTION AREAS)</u>				
Location	LBP Component	Substrate	Color	LBP Condition
1 st Floor, Outside Office #10	Wall	Glazed Block	Beige	Fair
1 st Floor, Outside Office #10	Wall Base Trim	Glazed Block	Brown	Fair
2 nd Floor, Passage Corridor	Wall	Glazed Block	Beige	Fair
2 nd Floor, Passage Corridor by Stairwell “D”	Wall	Glazed Block	Beige	Fair
2 nd Floor, Passage Corridor by Stairwell “D”	Wall Base Trim	Glazed Block	Brown	Fair
3 rd Floor Outside Room #319/Elevator	Wall	Glazed Block	Beige	Fair
3 rd Floor Outside Room #319/Elevator	Wall Base Trim	Glazed Block	Brown	Fair
3 rd Floor Room #302 Office	Radiator	Metal	Brown	Fair

It should be noted that several components tested did in fact contain minimal lead-levels below the EPA threshold level of 1.0 mg/sq. cm for classification as Lead-Based Paint (LBP) and are considered lead-containing coatings by the OSHA Regulation, "Lead Exposure in Construction" (29CFR 1926.62). OSHA does not recognize a minimum limit for lead concentration in paint for the purpose of disturbance. Monitoring of workers performing demolition/cleaning/disturbance of painted surfaces shall be completed to document personnel occupational exposure. Items containing any amount of lead concentration are considered lead-containing coatings per 29 CFR 1926.62, OSHA Lead Exposure in Construction.

END OF SECTION 028300

SECTION 030131 - STRENGTHENING OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section includes the design, furnishing and installation of externally bonded fiber-reinforced polymer (FRP) system including all materials, labor, equipment and services for the supply and installation of the FRP system as indicated on the Drawings and specified herein. Contractor shall provide access required for the proper installation of the FRP system.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to concrete maintenance including, but not limited to, the following:
 - a. Verify concrete-maintenance specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Quality-control program.
 - d. Coordination with building occupants.

1.3 PERFORMANCE REQUIREMENTS

- A. Design the FRP system to achieve the structural performance as indicated on the Drawings. Design calculations for the FRP system shall be prepared by a professional engineer registered in the State of New York and submitted for approval.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
- B. Submit for record, a qualification statement by the Contractor listing their completed FRP Reinforcement projects, including size, location, owner, engineer/architect and contact numbers.
- C. Submit for record a complete description of the FRP Reinforcing system materials, surface preparation, application procedures, application rates, and cure times.
- D. Submit for record copies of purchase order and packaging slips showing quantities and dates of primer and resin purchased.
- E. Submit for review and approval shop drawings including, the following:
1. Limits of FRP Reinforcing.
 2. Details of epoxy injection crack repair and epoxy resin patching.
 3. Complete system details including, but not limited to, FRP Reinforcement, primer, resin, and protective coating.
 4. Prepared under the supervision of a qualified professional engineer.
- F. Calculations:
FRP calculations stamped and signed by a qualified professional engineer. Design shall be based on the performance criteria indicated on the Drawings.
- G. Submit for record test results of the Pull-off test to determine FRP adhesion to concrete substrate.

- H. Submit for record Daily Construction Logs kept by the Contractor. These logs shall include the following information: Weather and temperature at application times; Amount of product used and square footage/linear footage of substrate covered; Batch numbers of all products used; Names of all crew members; Any bond-strength tests, noting location, quantity and who performed these tests.
- I. Submit an approved ICC Evaluation Report in the name of the proposed FRP system to be used on this project.
- J. Submit independent test report verifying the environmental durability of the proposed system to be used on this project. Such reports shall include as a minimum:
 - 1. 10,000 hr. resistance to high temperature (38C) and high humidity (100%)
 - 2. 10,000 hr. resistance to alkali solution (pH 9.5)
 - 3. 3,000 hr. resistance to dry heat (60C)
 - 4. resistance to 20 freeze/thaw cycles
 - 5. resistance to UV/condensation @ 100 cycles

1.5 QUALITY ASSURANCE

- A. Quality Control procedures performed by the Manufacturer shall include, but not be limited to the following:
 - 1. Manufacturer shall have a nationally recognized program of contractor training, certification and technical support.
 - 2. The Manufacturer shall have minimum ten years experience in FRP Reinforcement confirmed by actual field tests of minimum 100 successful installations.
 - 3. The Manufacturer shall be able to supply testing data to demonstrate system properties and durability of the actual FRP Reinforcement to be used.
- B. Quality Control procedures performed by the Contractor shall include, but not be limited to the following:
 - 1. The Contractor shall be trained by the Manufacturer and shall have completed a program of instruction in the use of FRP Reinforcement.
 - 2. The Contractor shall have a minimum of two years experience in FRP Reinforcement confirmed by actual field tests of at least 5 successful installations.
 - 3. The Contractor shall inspect all materials prior to application to assure that they meet specifications and have arrived to the job-site undamaged.
 - 4. The FRP Reinforcement shall be completely inspected by the contractor during and immediately following application of the composite materials. Conformance with the design drawings, proper alignment of fibers and quality workmanship shall be assured. Entrapped air shall be released or rolled out before the epoxy sets. Defects shall be noted in the Daily Construction Log.
 - 5. After FRP Reinforcement has cured, the contractor shall inspect all work to check for voids and or debonding. Repairs shall be made as per Par. 3.8 Repair of Defects, and noted in the Daily Construction Log.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver primer, saturant and protective coating in original, unopened containers with the Manufacturer's name, labels, product identification, and batch numbers.
- B. FRP Reinforcement shall be stored in a cool dry area away from direct sunlight, flame, moisture, or other hazards.

- C. Store primer, saturant and protective coating under conditions as recommended by the Manufacturer in a cool dry place out of direct sunlight. Products that have exceeded their shelf life shall not be used.
- D. Contractor is required to confirm that all materials used in accordance with this Section conform to local, state, and federal environmental and worker's safety laws and regulations.
- E. During operations Contractor shall maintain barricades.
- F. The Contractor shall properly dispose of empty containers in accordance with local regulations.

1.7 FIELD CONDITIONS

- A. Do not apply FRP Reinforcement materials if existing concrete surface is wet or if the ambient or surface temperature is below 40 F (4 C).
- B. The ambient temperature and temperature of the epoxy components shall be between 50 F (10 C) and 80 F (27 C) at the time of mixing. See appropriate technical data sheets for more specific instructions.
- C. Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.
- D. The Contractor is solely responsible for fume control and shall take necessary precautions against injury to Installer personnel or adjacent building occupants during application of primer and resin, etc. Contractor personnel shall use protective equipment and area shall be well vented to the outside. As a minimum, Installer must take the following precautions:
 - 1. Contractor to locate and protect building air intake during application.
 - 2. Contractor to follow all state, federal, and local safety regulations.
 - 3. Contractor to follow all Manufacturers' safety requirements as indicated on appropriate MSDS sheets.

PART 2 - PRODUCTS

2.1 FRP REINFORCEMENT FABRIC AND/OR LAMINATE

- A. FRP Reinforcement fabric shall be high strength, high modulus, fiber fabric that may be unidirectional or woven (in various fiber architectures) to suit specific repair needs.
 - 1. FRP Reinforcement fabric shall be of the type, size, layer and location as indicated on the Drawings.
 - 2. FRP Reinforcement fabric shall meet the following minimum requirements:
 - a. Laminate Tensile Strength, in primary fiber direction: 6,400 lbs/layer per ASTM D3039
 - b. Laminate Tensile Modulus, in primary fiber direction: 160.9 ksi per ASTM D3039
 - c. Laminate Elongation, at break: 1.45% per ASTM D3039
 - d. Dry Fabric Weight, minimum per square yard: 18 oz/yd²
 - e. Percent Laminate Tensile Strength, retained: 90%
 - f. Visual Defects: per ASTM D2563
 - 3. Approved products are:
 - a. SikaWrap Hex Fabrics, Sika Corp.
 - b. MasterBrace, BASF

- c. Alternate products must be submitted and approved by the Engineer a minimum of two weeks prior to the bid date.
- B. FRP Precured Strip shall be high strength, high modulus, unidirectional carbon fiber reinforced polymer (CFRP).
 - 1. FRP Precured Strip shall be of the type, size, layer and location as indicated on the Drawings.
 - 2. FRP Precured Strip, shall meet the following minimum requirements:
 - a. Laminate Tensile Strength, in primary fiber direction: 390,000 psi per ASTM D3039
 - b. Laminate Tensile Modulus, in primary fiber direction: 23.0x10⁶ psi per ASTM D3039
 - c. Laminate Elongation, at break: 1.69% per ASTM D3039
 - d. Laminate Thickness: 0.047 in.
 - e. Fiber Volume: 68% per ASTM D3039
 - 3. Approved products are:
 - a. Sika CarboDur, Sika Corp.
 - b. MasterBrace, BASF
 - c. Alternate products must be submitted and approved by the Engineer a minimum of two weeks prior to the bid date.

2.2 CONCRETE SURFACE PRIMER

- A. Surface Primer shall be a two component, 100% solids, moisture/tolerant, high modulus, high strength epoxy.
- B. Surface Primer shall meet the following minimum requirements:
 - 1. Tensile Strength: 8,000 psi minimum per ASTM D638
 - 2. Tensile Modulus: 250,000 psi minimum per ASTM D638
 - 3. Elongation at Break: 3.0% per ASTM D638
 - 4. Flexural Strength: 11,500 psi per ASTM D790
 - 5. Flexural Modulus: 500,000 psi per ASTM D790
 - 6. Heat Deflection Temperature: 120F (47C) per D648
- C. Approved products are:
 - 1. Sikadur 300, Sika Corp.
 - 2. MasterBrace, BASF
 - 3. Alternate products must be submitted and approved by the Engineer.

2.3 FABRIC SATURANT

- A. Saturant resin shall be two component, 100% solids, moisture tolerant, high strength, high modulus epoxy.
- B. Saturants shall meet the following minimum requirements:
 - 1. Tensile Strength: 8,000 psi minimum per ASTM D638
 - 2. Tensile Modulus: 250,000 psi minimum per ASTM D638
 - 3. Elongation at Break: 3.0% per ASTM D638
 - 4. Flexural Strength: 11,500 psi per ASTM D790
 - 5. Flexural Modulus: 500,000 psi per ASTM D790
 - 6. Heat Deflection Temperature: 120F (47C) per D648
- C. Approved products are:

1. Sikadur, Sika Corp.
2. MasterBrace, BASF
3. Alternate products must be submitted and approved by the Engineer.

2.4 EPOXY REPAIR MORTAR

- A. Repair mortar shall be 100% solids, non-sag paste epoxy.
- B. Approved products are:
 1. Sikadur, Sika Corp.
 2. BASF
 3. Alternate products must be submitted and approved by the Engineer.

2.5 PROTECTIVE COATING

- A. Protective coating shall be polymer or acrylic based and shall be UV resistant.
- B. Approved products are:
 1. Sikagard, Sika Corp.
 2. BASF
 3. Alternate products must be submitted and approved by the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Inspect surfaces to receive the work and report immediately in writing to the Engineer as required in the General Conditions and deficiencies in the surface that render it unsuitable for proper execution of this work.
- B. Protect vehicles, concrete, and other items surrounding work area from dust or damage due to Work of this Section.

3.2 CONCRETE MAINTENANCE

- A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.
- B. Comply with manufacturers' written instructions for surface preparation and product application.

3.3 SURFACE PREPARATION

- A. All concrete surfaces shall be dry and free of surface moisture and frost, and tested by the Contractor to evaluate moisture transmission in accordance with ASTM D4263 "Indicating Moisture in Concrete by the Plastic Sheet Method."
- B. All concrete surfaces shall be sound. Remove deteriorated concrete, dust, laitance, grease, paint, curing compounds, waxes, impregnations, foreign particles, and other bond inhibiting materials from the surface by blast cleaning or equivalent mechanical means.
- C. The concrete surface profile should be prepared to a minimum concrete surface profile (CSP) 3 as defined by the ICRA surface profile chips.
- D. All concrete surfaces shall be air blasted and vacuumed clean to a dust free condition.
- E. Concrete surface irregularities less than one inch shall be ground and smoothed and/or filled with an approved repair mortar with the addition of 1 part oven dried sand to make an epoxy mortar.

Surface irregularities shall be limited to less than 0.04 inches (1 mm). Surface irregularities greater than one inch shall be repaired using an approved cementitious repair mortar.

- F. External concrete corners shall be rounded to at least a 1/2" radius when perpendicular to fiber orientation and internal corners shall be smoothed by trowelling epoxy mortar into the corners.
- G. The adhesive strength of the concrete shall be verified after preparation by random pull-off testing (ACI 503R) at the direction of the Engineer. Minimum tensile strength is 200 psi with concrete substrate failure, or as approved by the Engineer.

3.4 MIXING PRIMER AND SATURANT

- A. Mix components in accordance with Manufacturer's recommendations.
- B. Diluting is not permitted. Pre-condition materials as indicated on technical data sheet.
- C. Mix only that quantity which can be used within its pot life.
- D. Do not batch delivered units into smaller quantities. Mix only full units.

3.5 PRIMER APPLICATION

- A. Apply primer in accordance with Manufacturer's recommendations.
- B. Primer may be applied with a brush or roller. Apply second coat as necessary after first coat has penetrated into concrete.
- C. Surface depressions shall be filled with epoxy filler per manufacturers' instructions.
- D. Primer must be covered with fiber within 24 hours of application, depending on temperature conditions. If 24-hour window is exceeded, the primed surfaces must be solvent wiped with a fast flashing solvent or roughened with sandpaper to break the amine blush.

3.6 FRP REINFORCEMENT APPLICATION

- A. Method 1: Wet Lay-Up
 1. Apply FRP Reinforcement in accordance with Manufacturer's recommendations.
 2. When using saturator equipment, follow Manufacturer's procedures for proper machine set-up and calibration. Rollers shall be calibrated to saturate the fabric with the proper resin-to-fabric ratio. The roller gap shall be checked daily by a qualified technician for accuracy. The resin-to-fabric ratio shall also be verified by resin usage and documented on the daily project logs.
 3. Once the fabric is saturated, it may then either be spooled for easy handling, or cut to specified lengths and booked for handling. Care must be taken not to damage the fibers.
 4. The fabric may then be applied to the surface with no delay. Work from one end to the other, taking care to orient the fibers as specified. Remove any air entrapped in the fabric with a ribbed roller or squeegee.
 5. Sheets shall be lapped in the longitudinal direction 6 inches minimum or as indicated on the Drawings. Note: no lapping is required of the sheets parallel to the direction of fiber orientation.
- B. Method 2: Dry Lay-Up
 1. Apply FRP Reinforcement in accordance with Manufacturer's recommendations.
 2. FRP Reinforcement sheets shall be cut beforehand into prescribed lengths. Sheets shall be lapped in the longitudinal direction 6 inches minimum or as indicated on the Drawings. Note: no lapping is required of the sheets parallel to the direction of fiber orientation.
 3. Follow Manufacturer's recommendations regarding primer open times.

4. Apply a primary saturant coat uniformly by roller brush.
 5. Apply FRP Reinforcement sheets fiber side down to the concrete over the fresh saturant using a ribbed roller to remove any air bubbles.
 6. FRP Reinforcement sheets shall be left alone for about 30 minutes allowing for the primary saturant to soak through the fabric. Correct any dislocation on lifting.
 7. Apply secondary saturant coat with roller over installed sheets in order to impregnate and replenish primary saturant.
 8. If succeeding FRP Reinforcement sheets are specified on the Drawings repeat application procedures.
- C. Method 3: Precured Strip Application
1. Apply FRP Precured Strip in accordance with Manufacturer's recommendations.
 2. Care shall be taken not to damage the fibers in handling and unpacking the Strips.
 3. Strips may be either delivered to project site in factory pre-cut lengths, or cut on site. Care must be taken not to fray or otherwise damage the fibers when field cutting. Follow Manufacturer's recommendations for field cutting of strips.
 4. Strips shall be cleaned with a fast flashing solvent to remove any bond inhibiting materials. A clean white cotton rag shall be used for this purpose. Continue cleaning the Strip in this manner until no black residue shows on the rag. Cleaning shall be performed the same day the strips are to be used.

3.7 CURING

- A. Protect finished installation of FRP Reinforcement from rain, sand, dust, etc. using protective sheeting or other barriers. Do not allow protective sheeting to come in contact with finished application.
- B. Curing of finished application shall be a minimum of 24 hours and in order to achieve full strength curing shall be extended for a period of two weeks at an average ambient temperature of 68 degrees F.

3.8 REPAIR OF DEFECTS

- A. Upon completion of the curing process, the installed system shall be checked for areas where saturant has not penetrated or where saturant has not completely cured. Such areas shall be epoxy injected to re-establish bond subject to the approval of the Project Engineer.
- B. Repair procedures shall be performed in accordance with guidelines established by ACI 440.2R and approved by the Project Engineer. All repairs shall be subject to the same application, curing and quality control specifications as the original work.
1. Small delaminations and voids less than 2 in² each are permissible as long as the delaminated area is less than 5% of the total laminate area and there are no more than 10 such delaminations per 10 ft².
 2. Medium sized delaminations and voids greater than 2 in² but less than 25 in² may be repaired by epoxy resin injection or ply replacement, depending on the size and number of delaminations and their location. The repair procedure should be determined by the Project Engineer.
 3. Larger size delaminations and voids greater than 25 in² should be repaired by selectively cutting away the affected sheet and applying an overlapping sheet patch of equivalent plies. The overlap should extend a minimum of 6 in. in all directions.

3.9 PROTECTIVE COATING

- A. Apply protective coating in accordance with Manufacturer's recommendations.

3.10 FIELD QUALITY CONTROL

- A. Field Inspection
 - 1. The contractor shall monitor the mixing of all epoxy components for proper ratio and adherence to manufacturer's recommendations. Record batch numbers for fabric and epoxy used each day, and note locations of installation. Measure square footage of fabric and volume of epoxy used each day. Complete report and submit to Owner, engineer-of-record and FRP composite system manufacturer.
 - 2. If a Certified Special Inspector is required, the Certified Special Inspector shall periodically observe all aspects of preparation, mixing, and application. All FRP composite applied areas shall be inspected, in accordance with the manufacturer's specifications for voids, bubbles, and delaminations. All defective areas shall be repaired as per Section 3.4 in this specification.
- B. ASTM D7522 and/or ASTM D4541 – Direct Tension Adhesion Tests
 - 1. Direct tension adhesion testing shall be conducted using the method described by ASTM D7522 and/or ASTM D4541. A minimum of one such test shall be performed for each 1,000 ft² (45m²) of surface area to be covered by the FRP application. Pull-off tests shall be performed on a representative adjacent area to the area being strengthened whenever possible. Tests shall be performed on each type of substrate or for each surface preparation technique used.
 - 2. The epoxy bonded to the prepared surface shall be allowed to cure as per manufacturer's requirements before execution of the direct tension pull-off test. The locations of the pull-off tests shall be representative and on flat surfaces. If no adjacent areas exist, the tests shall be conducted on areas of the installed FRP system subjected to relatively low stress during service.
 - 3. The minimum acceptable value for any pull-off test is 175 psi (100 psi for masonry). The average of the tests shall not be less than 200 psi (120 psi for masonry). Additional tests may be performed to qualify the work at each identified area. Each pull-off test is to exhibit a failure mode in the substrate and not the epoxy-to-substrate bond plane.
 - 4. NOTE: ASTM D7522/4541 testing is only required for "Bond-Critical" applications of the FRP system (i.e. bond of FRP-to-concrete is critical to strengthening performance of the system), unless otherwise required by the Engineer of Record.

3.11 CLEANING

- A. Uncured saturants may be cleaned from tools with an approved solvent and properly disposed.
- B. Cured saturants shall be removed by mechanical means and properly disposed.

END OF SECTION 03 0131

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
1. Footings.
 2. Ramp slab on existing roof slab.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with fly ash; subject to compliance with requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture, indicating quantity of each ingredient and admixtures proposed or required. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
 2. For mix designs based on trial, include proportions, test results, and graphic analysis indicating average compressive strength.
 3. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. 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 reinforcement.
- D. Schedule for Concrete Placement: Order-of-construction schedule by location in structure.
1. Include shop drawings indicating all construction joints required, including any anticipated joints due to placement schedule.
- E. Welding certificates.
- F. Qualification Data: For Installer.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- H. Material Certificates: For each of the following, signed by manufacturers; indicate compatibility with application of surface applied flooring products where applicable:
1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Curing compounds.
 6. Floor and slab treatments.
 7. Bonding agents.

8. Adhesives.
 9. Vapor retarders.
 10. Joint-filler strips.
 11. Repair materials.
- I. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- J. Field quality-control test and inspection reports.
1. Include copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site.
- K. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Comply with requirements of the Concrete Manufacturers Association "Concrete Plant Standards."
- B. Source Limitations: Obtain each type or 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.
- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 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.
 2. Review the following:
 - a. Coordination with special inspection and testing and inspecting agency procedures for field quality control.
 - b. Concrete finishes and finishing.
 - c. Cold- and hot-weather concreting procedures.
 - d. Curing procedures.
 - e. Construction contraction and isolation joints and joint-filler strips.
 - f. Vapor-retarder installation.
 - g. Steel reinforcement installation.
 - h. Floor and slab flatness and levelness measurement.
 - i. Concrete repair procedures.
 - j. Concrete protection.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store steel reinforcement off ground, under suitable cover or enclosed.
 - 2. Maintain ease of access for inspection and identification of materials.

PART 2 - PRODUCTS

2.1 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. Metal or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. 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.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
 - 1. Include supplementary requirement S1.
- 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.

2.3 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: Bolsters, 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 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.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Aggregates, General: Tested and passed within 6 months of use for the following:
 - 1. Gradation: ASTM C 136.
 - 2. Material Passing No. 200 Sieve: ASTM C 117.
 - 3. Organic Impurities: ASTM C 40.
 - 4. Soundness: ASTM C 88.
 - 5. Clay Lumps: ASTM C 142.
 - 6. Lightweight Constituents: ASTM C 123.
 - 7. Abrasiveness of Coarse Materials: ASTM C 131.
 - 8. Soft Particles: ASTM C 235.
 - 9. Freeze/Thaw Resistance: ASTM C 66, ASTM C 682.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S 3M South coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: As indicated in design mixes.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94 and potable.

2.5 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. Water Vapor Reducing Admixture: Provide in all concrete slab pours. Basis of design is Vapor Lock 20/20 manufactured by Specialty Products Group (SPG); telephone (877) 957-4626. email info@spggogreen.com. Substitutions will be considered subject to compliance with this section and appropriate substantiating data.

2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products:
 - a. Burke by Edoco; BurkeFilm.
 - b. ChemMasters; Spray-Film.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.

- d. Euclid Chemical Company (The); Eucobar.
 - e. L&M Construction Chemicals, Inc.; E-Con.
 - f. MBT Protection and Repair, Div. of ChemRex; Confilm.
 - g. Meadows, W. R., Inc.; Sealtight Evapre.
 - h. Sika Corporation, Inc.; SikaFilm.
 - i. Symons Corporation, a Dayton Superior Company; Finishing Aid.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd.** when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. Characteristics: Acrylic polymer blend; non-yellowing from ultraviolet exposure; dustproofs concrete.
 - 2. Products:
 - a. ChemMasters; Safe-Cure Clear.
 - b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
 - c. Euclid Chemical Company (The); Diamond Clear VOX.
 - d. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - e. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
 - f. Meadows, W. R., Inc.; Vocomp-20.
 - g. Sonneborn, Div. of ChemRex; Kure-N-Seal.
 - h. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
 - i. Tamms Industries, Inc.; Clearseal WB STD.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.8 REPAIR MATERIALS

- A. 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 topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.9 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 laboratory trial mixtures.
 - 2. Design mixes to meet or exceed each requirement specified. Adjust mix design to meet the most stringent requirement.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 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 set-accelerating corrosion-inhibiting admixture in concrete mixtures where indicated.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3500 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.50.
 - 3. Minimum Cementitious Materials Content: 475 lb/cu. yd.
 - 4. Maximum Nominal Aggregate Size: 1 inch.
 - 5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.
- B. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3500 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
 - 3. Minimum Cementitious Materials Content: 540 lb/cu. yd.
 - 4. Maximum Nominal Aggregate Size: 1 inch.
 - 5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.
- C. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
 - 3. Minimum Cementitious Materials Content: 590 lb./cu.yd.
 - 4. Maximum Nominal Aggregate Size: 3/8 inch.
 - 5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.
 - 6. Air Content: 4 to 6 percent.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Bend steel reinforcement in accordance with ACI 318.

1. Do not heat steel reinforcement for bending. Bend or straighten bars cold.
2. Do not bend partially embedded steel reinforcement, except as approved.

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, paragraphs 1 to 15 and 18 only, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 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.
 2. Class C, 1/2 inch for rough-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 cast 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 inspection ports where interior area of 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.

3.2 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.

3.3 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 deg 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 Architect.

3.4 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.
 - 2. Allow six hours between completion of reinforcement installation and placement of concrete for special inspection.
- B. Clean reinforcement of dirt, grease, scale, loose rust, oil, paint and other foreign matter prior to installation.
- 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. Splicing of Reinforcement: Conform to ACI 318 Chapter 12 for wired lap splices and embedment lengths.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. 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.
- G. Maintain required concrete cover dimensions indicated. Coordinate placement of conduit and inserts with reinforcement. Protect installed reinforcement from damage or displacement prior to and during concrete placement.

3.5 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 as approved by Architect.
 - 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 underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside 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 of 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. 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.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed and corrections made.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- 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 to not 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.
 - a. Supplement mechanical consolidation by hand, spading, rodding, or tamping.
 3. Do not use vibrators to transport concrete inside forms. 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 a continuous operation, within limits of construction joints, until placement of a 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 deg 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 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated 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 concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 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 a minimum 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, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces to receive concrete floor toppings, or to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish, or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten 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:
 - a. 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.
 3. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch

- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exposed concrete 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 Architect before application.

3.9 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.

3.10 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. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously 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 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. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments as recommended by manufacturer.
 - b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor coverings used on Project.

3. 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 subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 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(s). 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.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect'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 1/2 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 with 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 Architect.
- 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, popouts, 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. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. 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 a 3/4-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.
 7. 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 Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. 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 for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. 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 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 6. 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.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 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.
 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. 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 directed by Architect.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000

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SECTION 040215 – THIN BRICK PANEL SYSTEM

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Brick-it CI (Continuous Insulation) Panel System (Basis-of-Design).
- B. General & Supplementary Conditions & Requirements.

1.2 REFERENCES

ASTM International (ASTM):

- 1. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); severe weather grade kiln-fired brick.
- 2. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; specially formulated mortar mix.
- 3. ASTM C 513 - Standard Test Method for Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength; for bricks, minimum compression strength of 1000 PSI.
- 4. ASTM C 577 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- 5. ASTM C 666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing, brick, pass.
- 6. ASTM C 1088 - Standard Test Method for Thin Veneer Brick Units Made from Clay or Shale; severe weather grade kiln-fired brick.
- 7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- 8. ASTM E 754 - Standard Test Method for Pullout Resistance of Ties and anchors Embedded in Masonry Mortar Joints.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's installation instructions, showing required preparation and installation procedures.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Cleaning and maintenance instructions.
 - 5. Manufacturer's Warranty.
- B. Shop Drawings: Prepared by the applicator/contractor showing the wall layout, typical details, connections, expansion joints, plus the installation sequence. Shop drawings shall include the following:
 - 1. Submit elevations, sections and details of assembly components; indicate locations, configurations, large scale plans.
 - 2. Show sequence of installation, attachment details, and weather sealing.
 - 3. Show location of members, other items of work and related work of other Sections to be coordinated with work of this section.
 - 4. Submit detail drawings depicting proper installation and flashing techniques. Coordinate locations with those found on the Contract Drawings.

C. Quality Assurance Submittals:

1. Copies of test reports by independent laboratories verifying the performance of the system.
2. The certified applicator/contractor shall submit a copy of his current 'Certificate of Trained Applicator' from Brick-It prior to the application of the Brick-It Metal Grid Panel System.

D. Verification Samples: For each finish product specified, two samples, minimum size 1 inches (305 mm) by 12 inches (305 mm), representing actual products, styles, colors, patterns, and textures.

E. Warranty: Copy of manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

A. Single Source Requirements: Provide primary and secondary components required for installation of thin brick systems from a single source.

B. Manufacturer Qualifications: Minimum 20 years' experience manufacturing similar products.

C. Installer Qualifications:

1. Received instruction by manufacturer's personnel in the installation of the Brick-It System and received a 'Certificate of Trained Applicator' from Brick-It.
2. Five-Years experienced and competent in the installation of brick type materials.
3. Submit a list of recently completed projects using similar materials.

D. Performance Testing:

1. TAS 201 - Large Missile Impact Test
2. TAS 202 - Uniform Static Pressure Test
3. TAS 203 - Cyclic Wind Pressure Load Test
4. E84 - Flame Smoke Test
5. E754 - Shear Pull Test
6. NFPA 285 - All combustible components being required & used in part or as part of the projects composite wall assembly (such as insulation, weather resistive barrier, sheathing & adhesives) required to meet the NFPA 285 requirements unless otherwise exempt (see Part 2 "Products" 2.2 H. Insulation Board & 2.2 I. WRB).

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. The mock-up shall demonstrate the proposed range of color, texture, and workmanship to be expected in completed work.
2. Locate mock-up on site in location as directed by Architect. Clean the sample panel installation using the same materials and tools as planned for the final construction.
3. Obtain Architect's acceptance of mock-up before start of work.
4. Do not proceed with remaining work until workmanship, color, style, pattern, and texture are approved by Architect.
5. Remove mock-up at the completion of the work.

- F. Conduct a pre-installation meeting to verify all products, application procedures, site conditions and warranty terms.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the location in unopened factory containers. Upon arrival, materials shall be inspected for damage and manufacturer informed of any discrepancies. Deficient materials shall not be used.
- B. Materials shall be stored in a protected location and safeguarded from damage.

1.6 PROJECT CONDITIONS

- A. The ambient air temperature shall remain at 36 degrees F (2.2 degrees C) or greater for at least 72 hours after the application of mortar.
- B. Flashing and sealants shall be installed immediately after completion of the system. Provide temporary protection as needed from precipitation, wind, airborne dust and debris, and similar items.
- C. Provide protection of surrounding areas and adjacent surfaces from application of brick panel systems.

1.7 COORDINATION / SCHEDULING

- A. Coordinate installation of brick panel systems with related wall elements, including, windows, doors, louvers, ducts, signage, flashings, sealants, weather resistive barrier, sealant tapes and membranes, supporting wall framing and sheathing, surface mounted objects, and similar items.
 - 1. Coordinate with installation of flashing, coping and sealants to ensure that materials are installed in accordance with manufacturer's instructions.
 - 2. Coordinate with installation of surface-mounted objects to ensure that watertight seal is provided.

1.8 WARRANTY

- A. Manufacturer's Warranty: Standard 20-year limited warranty, which includes all system components manufactured &/or supplied by Brick-it.

PART: 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Brick-it located at: 17 Central Avenue, Hauppauge; Sales & Service: 631-244-3993, Technical 631-591-9222; Email: Info@brickit.com. Web: www.brickit.com or approved equal.
- B. Requests for substitutions will be considered in accordance with provisions of the Contract Documents.

2.2 BRICK PANEL SYSTEMS

- A. Brick Panel Systems: System for aligning and locking thin brick to a substrate that does not depend on adhesive for its performance.
 - 1. System Type: Brick-It (G90) Continuous Insulation Panel System.
 - 2. Wall Fabrication: Brick panel system shall be factory assembled and attached to prefabricated metal stud curtain wall system as indicated on the Drawings and in the Contract Documents.
- B. Metal Grid System Panels: Galvanized steel metal components formed to align brick courses and to support and ensure a mechanical bond of each brick in place.
 - 1. Panels shall be chem-dry treated and be a minimum 0.0149-inch (0.36 mm) thickness with continuous carrying brick ledges (every course of brick) with minimum thickness per ledge: 0.028 inch (0.71 mm).
 - 2. Panels shall have a continuous interlock every third course, minimum thickness, 0.042 inch (1.07 mm).
 - 3. Panels shall be able to fold out corners, door and window sections, and have a continuous linear array of holes to receive adhesive and have a continuous array of mortar receptors to lock in mortar mix.
 - 4. Panels shall be designed to carry brick load evenly on entire wall surface without the use of footings, starter angles or special corner sections.
 - 5. Panel Size: as determined by manufacturer for optimum installation.
 - 6. Size: Spacing for Brick Veneer – match existing masonry coursing.
- C. Brick: Kiln-fired brick 1/2 inch (13 mm) nominal thickness, meeting ASTM C 216 (for cut Face Brick) &/or ASTM C 1088 (for extruded Thin Brick), Grade SW, Type TBS, TBX, FBS, FBX, &/or PCI requirements.
 - 1. Brick Color: match existing.
- D. Mortar: Brick-it Type “S” premixed mortar supplied by to meet ASTM C 270 or approved equal.
 - 1. Mortar Color: match existing.
- E. Fasteners: Brick-it non-corrosive ribbed nails, screws or staples, designed for applicable substrate or approved equal.
- F. Adhesives: Brick-it high solid, solvent based silicone or construction adhesive that remains flexible and unaffected by freeze-thaw cycles (cut brick requires the use of Brick-it silicone adhesive only).
- G. Water: Shall be clean, potable, and free of all foreign matter.
- H. Insulation Board: Green Guard, Owens Corning or Dow minimum 25 PSI, 2” to maximum 6” XPS or approved equal.
- I. Weather Resistive Barrier: Shall be manufactured by Carlisle, Kingspan, Tyvek or approved equal.
- J. Rain Screen &/or Drainage Mat: Green Guard DC14, MTI Sure Cavity 3mm or 5mm.
- K. Cleaner: Prosoco, Deidrich Technologies or approved equal approved for use by Thin Brick Manufacturer.
- L. Masonry Sealer: Manufacturer's recommended sealer, applied to brick and mortar joints. Sealant Systems: Acceptable to Brick-It, color as selected by Architect. Joint design and surface preparation shall be based on sealant manufacturer's recommendation and project conditions.

PART 3 EXECUTION**3.1 EXAMINATION**

- A. Prior to installation, examine substrate for conditions including soundness, tightness of connections, crumbling or looseness of surfaces, and projections. Verify substrate is acceptable to manufacturer prior to installation of the work of this Section.
- B. Report deviations from the requirements of project specifications or other conditions that might adversely affect the installation to the Architect. Do not start work until deviations are corrected.

3.2 SUBSTRATE PREPARATION

- A. Repair damaged or cracked surfaces. Prepare substrate to be flat, within 1/8 inch (3.2 mm) within any 4 foot (1.2 m) square area.
- B. Remove surface contaminants on concrete and concrete masonry surfaces, such as form release oils, dust, paint, waterproofing, and similar items. If required by manufacturer, apply conditioner to substrate by sprayer or roller to chalking or excessively absorptive surfaces.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's written instructions as applicable to each type of substrate required. Install bricks to specified pattern and mortar.
- B. Metal Grid: Apply to substrate surface in the true level rows, interlock at every panel. Install such that panel does not extend 1/4 inch (6 mm) below the face of the brick.
 - 1. Offset vertical grid joints and leave 1/4 inch (6 mm) between joints. Install for brick to extend past grid by 1/2 inch (13 mm) at grid ends.
 - 2. Fasten grid system to a sound substrate or wall with a non-corrosive fasteners; minimum penetration of substrate is 1 inch (25 mm). Concrete and masonry walls require fasteners and adhesive on rear of metal grid.
 - 3. Install fasteners on an average of 3 per square foot (0.1 square meters) and at top and bottom courses vertically and a maximum of 16 inches (406 mm) on center horizontally.
- C. Adhesive:
 - 1. Brick shall be spaced to ensure that the head joints do not exceed 5/8 inch (16 mm) or fall below 1/4 inch (6.5 mm). The optimum head joint size is 7/16 inch (11 mm).
 - 2. Use adhesive supplied by manufacturer. For exterior installations, apply 3/8 inch (9.5 mm) vertical dabs.
 - 3. Do not use excessive adhesive as this will cause bricks to tilt away from grid. Check periodically and repress to grid.
 - 4. Allow adhesive 24 hours to dry before mortaring.
- D. Brick Placement:
 - 1. Applications Requiring Corners:
 - a. Start with corner brick, or a corner brick at each corner if there are corners at both ends.
 - b. Install bricks adjusting vertical joints for fit or cut brick as required.

2. Applications that do not require corners:
 - a. Install bricks in direction of arrows as shown in manufacturer's literature.
 - b. Place adhesive on two rows of grid in the middle of wall.
 - c. Adjust vertical joints to fit area, 3/8 inch to 1/2 inch (9.5 mm to 13 mm), to fit wall space.
 - d. Cut end bricks as needed. Install bricks horizontally than vertically.
 - e. Draw a plumb vertical line every 48 inches (1219 mm) to help maintain spacing.

E. Mortar:

1. Allow adhesive to fully cure before mortaring joints.
2. Use clean, cold water to mix mortar. Flush hoses regularly; especially during warm weather.
3. Slightly dampen bricks before mortaring; especially during hot weather.
4. Mix properly and test a sample area.
5. Do not apply mortar to brick panel system when the ambient outdoor temperature is below 36 degrees F (2.2 degrees C) unless temporary protection and heat can be provided for a minimum of 36 hours after installation.
6. Apply mortar into horizontal joints first, then vertical joints. Over fill joints with enough mortar to avoid leaving any voids. When mortar attains a firm consistency joints shall be tooled.
7. Use the joint tool supplied with the mortar kit to strike joints. Press the tool against the joint and strike joint to fill and seal mortar to edges of brick. Strike the vertical joints first than horizontal joints. Provide concave finish. Fill voids.

- F. Sealer: Apply only after mortar joints are thoroughly cured. Allow a minimum of 2 weeks prior to application. Seal in accordance with manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

- A. Arrange and pay for project inspection by Brick-It or its authorized representative to confirm warranty will be provided. Notify Architect 48 hours in advance of inspection.

3.5 CLEANING AND PROTECTION

- A. Cleaning: As recommended by manufacturer. Do not begin cleaning until mortar joints are properly cured. Allow a minimum of 24 to 72 hours. Soak bricks and mortar joints before applying cleaner.

1. Thoroughly flush wall after cleaning.
2. Clean adjacent materials and surfaces of all foreign materials resulting from the work of this Section.

B. Protection:

1. Protect installed materials from water impinging on the visible surface, chinking, sealants joints, and from behind.
2. Protect installed materials from dust, dirt, precipitation, freezing, damaged, spilled materials, and continuous high humidity until they are fully dry.

SECTION 04 2000 - UNIT MASONRY

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. Concrete masonry units.
 - 2. Concrete building brick.
 - 3. Mortar and grout.
 - 4. Steel reinforcing bars.
 - 5. Masonry joint reinforcement.
 - 6. Ties and anchors.
 - 7. Embedded flashing.
 - 8. Miscellaneous masonry accessories.
 - 9. Cavity wall insulation.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (fm) at 28 days:
 - 1. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 SUBMITTALS

- A. Product Data: For each different mortar mix, grout mix, masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples:
 - 1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction. For face brick, submit samples in the form of straps of five or more bricks.
 - 2. Weep holes/vents in color to match mortar color.
 - 3. Accessories embedded in the masonry.

4. Colored mortar showing the full range of colors available. For mortar that is to match the color of existing mortar, provide samples using same sand and mortar ingredients to be used on Project.
- D. 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. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- E. Material Certificates: For each type and size of the following:
 1. Masonry units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Grout mixes. Include description of type and proportions of ingredients.
 4. Reinforcing bars.
 5. Joint reinforcement.
 6. Anchors, ties, and metal accessories.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
- G. 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 Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- H. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Installer Qualifications: The masonry installation contractor shall provide qualified installers.
 1. All masonry flashing assemblies shall be installed by masonry craftworkers who have successfully completed the International Masonry Institute (IMI) (1-800-IMI-0988) upgrade training course for Masonry Flashing, or equivalent.
 2. Grouting and Reinforcing: All masonry and grouting and reinforcing work shall be performed by masonry craftworkers who have successfully completed the International Masonry Institute (IMI) (1-800-IMI-0988) training course for Grouting and Reinforced Masonry Construction, or equivalent.

3. Construction of the rain screen system (cavity wall construction) shall be performed by masonry craftworkers who have successfully completed the International Masonry Institute (IMI) (1-800-IMI-0988) Rain Screen Upgrade course, or its equivalent.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build sample panel of full thickness of the typical exterior wall from base of wall to three brick courses above the window, including the window itself (window need not be full size, but must have jamb depth/profile matching the windows to be used on the project). Sample panel shall include base flashing, weep holes, and window sill, jamb, and head construction.
 2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
 3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 4. Protect approved sample panels 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; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 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. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, cover a minimum of 24 inches down face next to unconstructed wythe and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building load-bearing masonry walls or columns.

- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 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 bullnose units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units, those in exterior walls, and where indicated.
 - 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 E 514 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) ACM Chemistries; RainBloc.
 - 2) BASF Aktiengesellschaft; Rheopel Plus.
 - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

- C. CMUs: ASTM C 90.
 - 1. Density Classification: **Lightweight** unless otherwise indicated.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 3. Specified compressive strength shall be:
 - a) $f'_m = 1,350$ psi for partially grouted construction,
 - b) $f'_m = 1,500$ psi for fully grouted construction,
 - c) Minimum average net-area compressive strength of units shall be 1,900 psi.
- D. Concrete Building Brick: ASTM C 55.
 - 1. Density Classification: **Lightweight**.
 - 2. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.3 CONCRETE AND MASONRY LINTELS

- A. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete" and with reinforcing bars indicated.
- B. 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.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
 - 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.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.

- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ACM Chemistries; RainBloc for Mortar.
 - b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Interior Walls: Mill- galvanized, carbon steel, ASTM A641/A641M.
 2. Exterior Walls: ASTM A580/ASTM A580M, Type 316 stainless steel.
 3. Wire Size for Side Rods: 0.148-inch diameter.
 4. Wire Size for Cross Rods: 0.148-inch diameter.
 5. Wire Size for Veneer Ties: 0.148-inch 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.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods:
1. Wire size: 9 gauge side rods x 9 gauge cross rods.
 2. Type 316 stainless steel.
 3. Basis of Design: Hohmann & Barnard, Inc. 220 Ladder-Mesh, or 120 Truss-Mesh.
- D. Masonry Joint Reinforcement for Multi-wythe Masonry:
1. 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 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.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
 2. Stainless-Steel Wire: ASTM A 580/A 580M, **Type 316.**
 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
 4. Steel Plates, Shapes, and Bars: ASTM A 36.
 5. Stainless-Steel Sheet: ASTM A 666, **Type 316.**
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, stainless-steel wire.
 - a. Basis of Design: Hohmann & Barnard , Inc. 359-C-Weld-On Ties.
2. Tie Section: Wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, Type 316 stainless-steel wire.
 - a. Basis of Design: Hohmann & Barnard , Inc. Vee Byna-Tie or 301W Column Web Tie, as applicable.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, Type 316 stainless steel sheet.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, Type 316 stainless steel wire.
 3. Basis of Design: Hohmann & Barnard 305 Dovetail Slot and 315 Flexible Dovetail Brick Tie.
- E. Partition Top anchors: 0.105-inch- thick metal plate with 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. Type 316 stainless steel.
 2. Basis of Design: Hohmann & Barnard, Inc, 305 Dovetail Slot and 315 Flexible Dovetail Brick Tie

2.7 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.
- C. Postinstalled Anchors: Chemical anchors.
 1. Load Capacity: 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 E 488, conducted by a qualified independent testing agency.
 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 EMBEDDED FLASHING MATERIALS

- A. Thru wall flashing system: A preassembled system that integrates a flashing membrane, drainage mat, weeps, and drip edge.
 1. **Manufacturer: Mortar Net.**
 2. **Product: Total Flash System with the following options:**
 - a. **Membrane: 5 oz Copper Laminate 18".**
 - b. **Termination Bar: 1-1/4 x 16 gauge thick.**
 - c. **Drip Edge: 3 inch depth, 16 gauge thick with 3/8 inch hem.**

- d. **Adhesive: As recommended by the manufacturer for the material specified.**
 - e. **Preformed end dams and corner boots as required for a complete installation.**
- B. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
- 1. Stainless Steel: ASTM A 240, Type 316, 26 gauge thick.
 - 2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 - 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 4. Metal Drip Edge: Fabricate from Type 316 stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees **and hemmed.**
 - a. Basis of Design: Hohmann & Barnard, Inc., Drip Plate, Standard DP.
 - 5. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Cheney Flashing Company; Cheney 3-Way Flashing (Sawtooth).
 - 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
 - 3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
 - 6. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - 7. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 8. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
 - 9. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
- C. Flexible Flashing: Use the following unless otherwise indicated:
- 1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Basis of Design: Hohmann & Barnard, Inc., C-Fab Flashing.
- D. 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 sealant stop or flexible flashing with a metal sealant stop.
 - 4. Where flashing is fully concealed, use metal flashing or flexible flashing.
- E. Solder and Sealants for Sheet Metal Flashings:
- 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from **neoprene**.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one the following unless otherwise indicated:
 - 1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long, with cotton wick and stainless steel screen.
 - a. Basis of Design: Hohmann & Barnard, Inc., 341 Series Round Plastic Weep Holes, Model W/S.
 - 2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, 1.5 inches height by 3/8 inches wide by 3.5 inches deep, with cotton wick and stainless steel screen.
 - a. Basis of Design: Hohmann & Barnard, Inc., 342 Rectangular Plastic Weep Holes, Model W/S.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Basis of Design: Hohmann & Barnard, Inc., Mortar Trap.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, Type 316 stainless steel. Provide units designed for number of bars indicated.
 - 1. Basis of Design: Hohmann & Barnard, Inc., RB or RB-Twin Rebar Positioner.

2.10 MASONRY-CELL INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Concrete Block Insulating Systems; Korfil.
 - b. Shelter Enterprises Inc.; Omni Core.

2.11 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, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.12 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.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use **Type S**.
 2. For reinforced masonry, use **Type S**.
 3. For mortar parge coats, use Type S.
 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- C. Pigmented Mortar: 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. Mix to match color of existing mortar.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
 - c. Face brick.
 - d. Cast stone trim units.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Mix to match color of existing mortar.
 2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
 - c. Face brick.
 - d. Cast stone trim units.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the 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.
 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 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.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Face brick at exterior wall shall match coursing of existing brick.
- 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 racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- 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. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 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.
- 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.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to **concrete and masonry backup** with masonry-veneer anchors to comply with the following requirements:
 - 1. Embed **connector sections and continuous wire** in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of back-up wythe.
 - 2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.10 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
- C. Form expansion joints in brick as follows:
 - 1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide **concrete or 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.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND 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 vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 4. 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 Division 07 Section "Joint Sealants" for application indicated.
 - 5. Install metal **sealant stops** with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 6. Install metal flashing termination 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 flashing termination.
 - 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

- E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.

3.13 REINFORCED UNIT MASONRY INSTALLATION

- A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- B. 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 ACI 530.1/ASCE 6/TMS 602 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.

3.14 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 shall be provided according to the Building Code of New York State.
 - 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 Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at **7 days and at 28 days**.

3.15 PARGING

- A. Where indicated, parge exterior faces of below-grade masonry walls in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.16 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. 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.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 FIELD QUALITY CONTROL

- A. Inspecting: Owner will engage an inspector to perform inspections and prepare reports for thru wall flashing installation. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
- B. All thru wall flashing installed in this project shall be water tested to verify completed installations will perform as designed. These tests shall be witnessed and approved by the Owner's representative.
 - 1. Testing will require that water be run into the brick cavity for a period of one hour to verify that no leaks exist. End dams are required at the end of all continuous through wall flashings so the water is directed to the weeps.

3.18 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. Excess Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

END OF SECTION 04 2000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
 - 3. Division 09 painting Sections for surface-preparation and priming requirements.

1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use ASD; data are given at service-load level.
- B. Construction: Moment frame.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For qualified Installer, fabricator, professional engineer and testing agency.
- D. Welding certificates.
- E. Mill test reports for structural steel, including chemical and physical properties.
- F. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators (if used).
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

G. Source quality-control reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Fabricators certified under the AISC Quality Certification Program in a category of structural steel work appropriate to the work defined are exempt from Special Inspection requirements for “On premises inspection of fabricated items”, and “Review each Fabricator’s quality control procedures” as listed in Specification 014533. Non-AISC fabricators shall be subject to these special inspections, and shall be responsible for the inspection costs associated with these inspections
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
- F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

- A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS**2.1 STRUCTURAL-STEEL MATERIALS**

- A. W-Shapes: ASTM A992.
- B. Channels, Angles-Shapes: ASTM A36.
- C. Plate and Bar: ASTM A36.
- D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with plain finish.
- B. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A563 heavy-hex carbon steel.
 - 2. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 3. Finish: Plain.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Mark and match-mark materials for field assembly.
 - 2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
 - 1. Do not thermally cut bolt holes or enlarge holes by burning.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, except slip critical at wind frames and moment connections.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive spray applied fire proofing.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
 - 2. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
 - 4. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Weld plate washers to top of baseplate.
 - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, except slip critical for wind frames and moment connections.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Ultrasonic Inspection: ASTM E164.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A780 and manufacturer's written instructions.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Field quality-control test and inspection reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- G. Research/Evaluation Reports: For steel deck.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Steel Deck:
 - a. Consolidated Systems, Inc.
 - b. Epic Metals Corporation.
 - c. Marlyn Steel Decks, Inc.
 - d. Nucor Corp.; Vulcraft Division.
 - e. Roof Deck, Inc.
 - f. United Steel Deck, Inc.
 - g. Verco Manufacturing Co.
 - h. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
1. Galvanized Steel Sheet: ASTM A 653, Structural Steel, Grade 33, G60 zinc coating.
 2. Deck Profile: Type WR, wide rib.
 3. Profile Depth: 1-1/2 inches, unless otherwise indicated.
 4. Design Uncoated-Steel Thickness: 0.0358 inch.
 5. Span Condition: As indicated.
 6. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, thick, with factory-punched hole of 3/8-inch minimum diameter.
- G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

- H. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height or 0.2 inches, whichever is less.
 - 2. Design framing systems to provide for movement of framing members 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.
 - 3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.3 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, temporary and permanent bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 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.
- F. Research/Evaluation Reports: For cold-formed metal framing.

1.4 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. 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, ductility, and metallic-coating thickness.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
1. Dale/Incor.
 2. Dietrich Metal Framing; a Worthington Industries Company.

3. MarinoWare; a division of Ware Industries.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST33H or as required by structural performance.
 2. Coating: G60, A60, AZ50, or GF30.
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: 50, Class 1 or 2 or as required by structural performance.
 2. Coating: G90.

2.3 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: 0.0428 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: Matching steel studs.
 2. Flange Width: 1-1/4 inches.
- C. 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 and lateral loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.
- 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.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight 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, knee braces, and girts.
 9. Hole reinforcing plates.
 10. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, 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.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. 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: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 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 screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance 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 metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to 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 metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 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, and complying 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 comparable in intensity 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 and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing 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 standard punched openings.
- J. Erection Tolerances: Install cold-formed metal 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.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as indicated.
- 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-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.

- 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 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. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Loose steel lintels.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

1.2 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 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to 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."

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 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 A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677-inch minimum thickness; unfinished.
- F. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- H. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

2.2 FASTENERS

- A. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchors, General: 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 E 488/E 488M, conducted by a qualified independent testing agency.
- D. Post-Installed Anchors: Torque-controlled expansion anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
- E. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

2.3 MISCELLANEOUS MATERIALS

- A. 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.

2.4 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. 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.
- D. 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.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. 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.

2.5 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide 8" minimum bearing length at each side of openings.
- C. Loose lintels to be galvanized in weathered conditions.

2.6 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 as required.

2.7 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel plate and angle support framing. Provide smooth exposed edges. Miter corners at concealed support framing.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Prime miscellaneous steel trim with water based anti-corrosion primer.

2.8 FINISHES, GENERAL

- 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.

2.9 STEEL AND IRON FINISHES

- A. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- B. Shop prime all iron and steel items.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. 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.

PART 3 - EXECUTION**3.1 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.

3.2 INSTALLING 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 operable partitions securely to, and rigidly brace from, building structure.

3.3 ADJUSTING AND CLEANING

- A. 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.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Plastic-laminate cabinets.
 2. Plastic-laminate countertops.
 3. Window sills.
 4. Interior standing and running trim.

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.3 SUBMITTALS

- A. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, cabinet hardware and accessories, handrail brackets, and finishing materials and processes.
1. Include data for fire-retardant materials and treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.
- C. Samples for Verification:
1. Lumber with transparent finish, not less than 1-1/2 inches wide by 4 inches long, for each species and cut, finished on 1 side and 1 edge.
 2. Plastic laminates, 2 by 3 inches, for each type, color, pattern, and surface finish.
- D. Product Certificates: For each type of product, signed by product manufacturer.
- E. Qualification Data: For fabricator.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.
- C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.
- D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

- E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- F. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 - 1. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 - 3. Marine Grade Panel Products (Marine Plywood):

- C. Thermoset Decorative Panels: Particleboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Nevamar Company, LLC; Decorative Products Div.
 - d. Panolam Industries International Incorporated.
 - e. Westinghouse Electric Corp.; Specialty Products Div.
 - f. Wilsonart International; Div. of Premark International, Inc.
- E. Colors and Patterns: As selected by Architect from manufacturer's full range of standard colors.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, 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.
 - 1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 - 1. For panels **3/4 inch** thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, **1600 psi**; modulus of elasticity, **300,000 psi**; internal bond, **80 psi**; and screw-holding capacity on face and edge, **250 and 225 lbf**, respectively.
 - 2. For panels **13/16 to 1-1/4 inches** thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, **1300 psi**; modulus of elasticity, **250,000 psi**; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, **250 and 175 lbf**, respectively.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Flakeboard Company Limited; Duraflake FR.
 - b. SierraPine; Encore FR.

2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: PVC edge banding, 3mm thick, matching laminate in color, pattern, and finish.
- G. Materials for Semi-exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3mm thick, matching laminate in color, pattern, and finish.
- H. Drawer Construction: Fabricate with exposed fronts fastened to sub-front with mounting screws from interior of body.
 - 1. Join sub-fronts, backs, and sides with dovetail joints supplemented by mechanical fasteners or glued and doweled joints.

2.4 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut:
 - 1. Species: White Maple.
 - 2. Cut: Plain sliced/plain sawn.
 - 3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- C. For base wider than available lumber, glue for width. Do not use veneered construction.

2.5 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- C. Steel Angle Brackets: For counter support.
 - 1. Manufacturer: Doug Mockett

2. Model: Size: 18", 24" and 30" as indicated on the drawings.
 3. Finish: Satin Stainless
- D. Spring Loaded Folding Bracket:
1. Manufacturer: Sugatsune
 2. Models:
 - a. 38830-25
 - b. 38845-25
 - c. 38860-25
 3. Finish: Anodized Aluminum
- E. Back-Mounted Pulls: BHMA A156.9, B02011.
- F. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 and BHMA A156.9, B04102; with shelf brackets, B04112.
1. Manufacturer: Knape and Vogt
 2. Install recessed into the millwork.
- H. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
 2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
 3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
 4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
 5. Keyboard Slides: Grade 1HD-100; for computer keyboard shelves.
 6. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 inches high and 16 inches wide.
- I. Door Locks: BHMA A156.11, E07121.
- J. Drawer Locks: BHMA A156.11, E07041.
- K. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

- C. Handrail Brackets: Cast from aluminum with wall flange drilled and tapped for concealed hanger bolt and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.
- D. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels; one for fastening to back of rail and one for fastening to face of wall. They are then assembled in overlapping fashion and fastened together top and bottom with self-tapping screws. Sized to provide 1-1/2-inch clearance between handrail and wall.
- E. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- F. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesive: 250 g/L.
- G. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Use un-pigmented contact cement with through-color laminate.

2.7 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.8 SHOP FINISHING

- A. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing opaque-finished architectural woodwork.
- B. Shop Priming: Shop apply the prime coat including backpriming for items specified to be field finished. Refer to Division 09 painting Sections for material and application requirements.
- C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- D. Transparent Finish:
1. Grade: Premium.
 2. AWI Finish System: Conversion varnish.
 3. Staining: Match approved sample for color.
 4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 5. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of **1/8 inch in 96 inches**.
- C. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
 3. Install standing and running trim with no more variation from a straight line than **1/8 inch in 96 inches**.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 1. Install cabinets with no more than **1/8 inch in 96-inch** sag, bow, or other variation from a straight line.

2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than **16 inches** o.c.
 - a. Use No. 10 wafer-head screws sized for **1-inch** penetration into wood framing, blocking, or hanging strips.
 - b. Use No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 2. Install countertops with no more than **1/8 inch in 96-inch** sag, bow, or other variation from a straight line.
 3. Secure backsplashes to tops with concealed metal brackets at **16 inches** o.c. and to walls with adhesive.
 4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- J. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **24 inches** long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 2. Install trim after gypsum-board joint finishing operations are completed.
 3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork and casework on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 4023

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 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

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded Polystyrene Board, ASTM C 578, Type V, **100-psi** minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
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. [DiversiFoam Products.](#)
 - b. [Dow Chemical Company \(The\).](#)
 - c. [Owens Corning.](#) Basis of Design: FOAMULAR 1000 Extruded Polystyrene Rigid Insulation.
 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 3. Application: Foundation insulation.

2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics and made with no formaldehyde.
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:
- [CertainTeed Corporation.](#)
 - [Guardian Building Products, Inc.](#)
 - [Johns Manville; a Berkshire Hathaway company.](#)
 - [Knauf Insulation.](#)
 - [Owens Corning.](#)
- B. Glass-Fiber Blanket, -Foil Faced: ASTM C 612, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
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:
- [CertainTeed Corporation.](#)
 - [Guardian Building Products, Inc.](#)
 - [Johns Manville; a Berkshire Hathaway company.](#) Min Wool Curtain Wall (Basis of Design)
 - [Knauf Insulation.](#)
 - [Owens Corning.](#)
- C. Sound Attenuation Glass-Fiber Blanket, (SABS) ASTM C 665, Type I
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:
- [Owens Corning.](#)(SABS)
 - Johns Manville (SAFB)
2. Install in thickness to meet partition STC Rating.

2.3 MINERAL-WOOL BLANKETS

- A. [Insulation shall comply with the](#) 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. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 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. [Industrial Insulation Group, LLC \(IIG-LLC\).](#)
- b. [Roxul Inc.](#)
- c. [Thermafiber Inc.; an Owens Corning company.](#)

2.4 SAFING INSULATION

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics and made with no formaldehyde.

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. [CertainTeed Corporation.](#)
- b. [Guardian Building Products, Inc.](#)
- c. [Johns Manville; a Berkshire Hathaway company.](#) Min Wool (Basis Of Design)
- d. [Knauf Insulation.](#)
- e. [Owens Corning.](#)

2.5 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. 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.](#)

2.6 ACCESSORIES

- A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- 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.
1. Adhesives shall have a VOC content of 70 g/L or less.
 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 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.

3.2 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. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. 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.

3.3 INSTALLATION OF SLAB INSULATION

- A. On horizontal surfaces, loosely lay insulation units as indicated on the drawings instructions. Stagger end joints and tightly abut insulation units.

3.4 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. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 3. 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.
 4. 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.

3.5 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. 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. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately **2.5 lb/cu. ft.**
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100

SECTION 074213 - INSULATED WINDOW PANELS

PART 1 - GENERAL**1.01 - Scope**

1. Basis of Design: The Panels required are as manufactured by Mapes Architectural Panels, LLC, Lincoln, NE. Panels consist of metal skins laminated to stabilizer substrates with an insulating core material. Panels are designed to be glazed into a window system or curtain wall system.

1.02 - Quality Assurance

1. Panel manufacturer shall have a minimum of 25 years experience.
2. Field measurements shall be taken prior to completion of manufacturing and cutting.
3. Maximum deviation from vertical and horizontal alignment of installed panels is 1/8" (3mm) in 20' (6m) non-commutative.

1.03 - References

1. American Society of Testing Materials (ASTM)
 - A. E330-84: Structural Performance of Exterior Windows, Curtain Walls and Doors under the influence of wind loads.
 - B. D1781-76: Climbing Drum Peel Test for Adhesives.
 - C. D3363-74: Method for Film Hardness by Pencil Test.
 - D. D2794-90: Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
 - E. D3359-90: Method for Measuring Adhesion by the tape test.

1.04 - Substitutions

1. The materials and products specified in this section establish a minimum standard of required function, design, appearance quality and warranty to be met by any proposed substitution.

1.05 - Submittals

1. Samples:
 - A. Panel makeup - 2 samples - 10"x10".
 - B. Two samples of each color and finish texture - 3"x5".
2. Shop Drawings: Indicate thickness, dimension and components. Detail glazing methods, framing and tolerances to accommodate thermal movement.
3. Affidavit certifying materials meet all requirements as specified.
4. 2 copies of manufacturers standard literature for specified material.

1.06 - Delivery, Storage and Handling

1. Protect finish and edge in accordance with panel manufacturer's recommendations.
2. Store materials in accordance with panel manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 - Panels - Laminated

1. Basis of Design: Laminated metal faced Mapes-R panels as manufactured by Mapes Industries, Inc.

2.02 - Finish

1. Finishes:
 1. Exterior: Custom Kynar.
 2. Interior: Standard Kynar.
2. Color as selected by Architect.

2.03 - Panel Fabrication

1. Mapes R+ Panel:
 1. Exterior Substrate: Cement Board.
 2. Exterior Core: Isocyanurate
 3. Smooth Mill Aluminum.
 4. Secondary Exterior Substrate: Cement Board.
 5. Interior Core: Isocyanurate.
 6. Interior Substrate: Cement Board.
 7. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness.
 8. Overall Panel Thickness – 4.25"
 9. Glazing Leg Thickness - 1".
 10. R-Value – 30.18.
 11. U-Value - 0.03.

2.04 - Accessories

1. Recommended for use as an infill panel component in window and curtain wall systems. Related material to complete installation as recommended by the manufacturer.
2. Seals providing a minimum of 20 year warranty against moisture intrusion as recommended by the manufacturer.

PART 3 – EXECUTION

3.01 - Installation

1. Panel surfaces shall be free from defects prior to installation.

3.02 - Execution

1. Erect panels plumb, level and true.
2. Glaze panels securely and in accordance with approved shop drawings and manufacturer's written instructions to allow for necessary thermal movement and structural support.
3. Do not install panels that are defective including warped, bowed, dented, scratched and delaminating components.
4. Weatherseal all joints as required using methods and materials as previously specified.
5. Separate dissimilar metals using gasketed fasteners and blocking to eliminate the possibility of electrolytic reaction.

3.03 - Adjusting and Cleaning

1. Remove masking film as soon as possible after installation. Masking intentionally left in place after panel installation will be the responsibility of the contractor.
2. Weep holes and drainage channels must be unobstructed and free from dirt and sealant.

END OF SECTION 07 4213

SECTION 07 5320 - EPDM ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Adhered membrane roofing system.
 - 2. Roof insulation.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.
- D. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that

are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: SH Severe Hail.

- E. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the factored design uplift pressures calculated according to SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems."

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
1. Base flashings and membrane terminations.
 2. Tapered insulation, including slopes.
 3. Insulation fastening patterns.
- C. Samples for Verification: For the following products:
1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
 2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
 3. 12-by-12-inch (300-by-300-mm) square of walkway pads.
 4. 12-inch (300-mm) length of metal termination bars.
 5. Fasteners of each type, length, and finish required for attachment of insulation, roof board, etc.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
1. Submit evidence of meeting performance requirements.
- F. Qualification Data: For Installer and manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- H. Research/Evaluation Reports: For components of membrane roofing system.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.

- K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for membrane roofing system identical to that used for this Project.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain components for membrane roofing system from same manufacturer as roofing membrane and/or approved by roofing membrane manufacturer in order to meet specified warranty requirements.
- E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
 - 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
- F. Pre-installation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
 1. Special warranty shall be a Total System Warranty which shall include roofing membrane, base flashings, roofing accessories, roof insulation, fasteners, cover boards, vapor retarder, walkway products, etc. and other components of membrane roofing system.
 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 EPDM ROOFING MEMBRANE

- A. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM, and as follows:
1. Available Manufacturers:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. GenFlex Roofing Systems.
 - d. Johns Manville International, Inc.
 2. Thickness: 60 mils (1.5 mm), nominal.
 3. Exposed Face Color: Black.
 4. Product: Sure-Seal EPDM Roofing Membrane as manufactured by Carlisle SynTec Incorporated.
 5. New work shall maintain all existing warranties.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 6-inch wide minimum, butyl splice tape with release film.
- E. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.

- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- H. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, prepunched.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
- K. Liquid coating, specifically formulated for coating EPDM roofing membrane, as follows:
 - 1. Type: Acrylic emulsion.
 - 2. Color: White.

2.4 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.
 - 1. Product: Subject to compliance with requirements, provide "Dens-Deck" manufactured by Georgia-Pacific Corporation.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck.

2.5 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Grade II, Class 1 fiberglass facer on both major surfaces.
 - 1. Manufacturers:
 - a. Carlisle SynTec Incorporated.
- C. Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.
 - 1. Product: Subject to compliance with requirements, provided "Dens-Deck Prime" manufactured by Georgia-Pacific Corporation.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to recommendations in FMG's "Approval Guide" for specified Windstorm Resistance Classification, and/or per membrane roofing system manufacturer's written instructions, whichever is more stringent.

3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Adhered Insulation: Install each layer of insulation and adhere to substrate per roofing membrane manufacturer's written instructions.
 - 1. Set each layer of insulation in a cold fluid-applied adhesive.
- H. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

- I. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 3. Install subsequent layers of insulation in a cold fluid-applied adhesive.
- J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck.
 - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- D. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- F. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
 - 1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
- G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
- H. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

- I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- J. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 COATING INSTALLATION

- A. Apply coatings to roofing membrane according to manufacturer's written recommendations, by spray, roller, or other suitable application method.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do 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.

3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5320

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Flashing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated 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. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.

5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.

C. Qualification Data: For qualified fabricator.

D. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that 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.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 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. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
 1. Non-Patinated Exposed Finish: Mill.

- C. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. As-Milled Finish: Standard two-side bright finish.
 - 2. Surface: Smooth, flat.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
 - 1. Finish: 2B (bright, cold rolled).
 - 2. Surface: Smooth, flat.

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum **30 to 40 mils (0.76 to 1.0 mm)** 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. Thermal Stability: ASTM D 1970; stable after testing at **240 deg F (116 deg C)**.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus **20 deg F (29 deg C)**.
 - 3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- C. Slip Sheet: Building paper, **3-lb/100 sq. ft. (0.16-kb/sq. m)** minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item 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 or manufactured item.
 - 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.

- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze or 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.
- C. Solder:
 - 1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - 2. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, 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 complying with ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. 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.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with butyl sealant concealed within joints.
- 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 SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Flashing: Fabricate from the following materials:
 - 1. Copper: **16 oz./sq. ft. (0.55 mm thick) weight (thickness).**
 - 2. Aluminum: 0.032 inch thick.
 - 3. Stainless Steel: 0.019 inch thick.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: **0.019 inch (0.48 mm)** thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated.
- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than **2 inches (50 mm)**.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than **6 inches (150 mm)** staggered **24 inches (600 mm)** between courses. Overlap side edges not less than **3-1/2 inches (90 mm)**. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than **12 inches (300 mm)** apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not

be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with sealant concealed within joints.

- D. Fastener Sizes: Use fasteners of sizes recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than **1 inch (25 mm)** into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below **40 deg F (4 deg C)**.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- F. 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 (38 mm)**, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder aluminum sheet.
 - 2. 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. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 4. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in existing mortar joints, reglets or receivers and fit tightly to base flashing. Extend counterflashing **4 inches (100 mm)** over base flashing. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with sealant. Secure in a waterproof manner.
- C. 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.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.7 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following manufactured roof specialties:
 - 1. Roof edge flashings and fascia.
 - 2. Counterflashings.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. FMG Listing: Manufacture and install roof edge flashings that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-90. Identify materials with FMG markings.
- C. Uniform Wind Load Capacity: Provide systems that, when installed, shall withstand positive and negative design wind loading pressures complying with all applicable codes and regulations having jurisdiction over this Project. Test pressures for testing purposes shall be based on scientifically obtained wind pressure coefficients. Capacity shall be determined using test procedures established by SPRI Wind Design Guide for Edge Systems Used With Low Slope Roofing Systems. Systems shall also comply with Factory Mutual Engineering & Research (FM), Loss Prevention Data 1-49, Perimeter Flashing, latest edition.
- D. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.
- F. Applicable Standards:

1. Aluminum Association (AA), Design System for Aluminum Finishes.
2. American Architectural Manufacturer's Association (AAMA), standards as referenced herein.
3. Factory Mutual Engineering & Research (FM), Loss Prevention Data 1-49, Perimeter Flashing, latest edition.
4. Single Ply Roofing Institute (SPRI), Wind Design Guide for Edge Systems used With Low Slope Roofing Systems, latest edition.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
 1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
 2. Details for expansion and contraction.
- C. Fabrication Samples: For copings, roof edge flashings, and counterflashings made from **12-inch (300-mm)** lengths of full-size components including fasteners, cover joints, accessories, and attachments.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of copings and roof edge flashings with performance requirements.
- E. Intent to Warrant: Submit an intent to warrant, executed by an authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications and conditions affecting the work, and proposes to provide warranties as referenced herein without further stipulation.
- F. All details shall be submitted to roofing system manufacturer and approved for use by the manufacturer as to meeting requirements necessary to obtain the total system warranty. Certification of said approval shall be submitted prior to fabrication.

1.5 QUALITY ASSURANCE

- A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store materials off ground under cover. Protect from damage and deterioration.
- B. Handle materials to prevent damage to surfaces, edges and ends of sheet metal items. Reject and remove damaged material from site.

1.7 WARRANTIES

- A. Provide Installer's Warranty warranting system to be free of defects in materials and workmanship and to be installed in strict accordance with manufacturer's shop drawings and/or installation instructions. Warranty period shall be twenty years.
- B. Provide Manufacturer's Warranty warranting system to be free of defects in materials and workmanship, to resist blow-off and to be leak tight. Warranty period shall be twenty years.
- C. Provide manufacturer's warranty warranting anodized coatings to be free from defects including checking, peeling or fading for a period of two years.
- D. Warranties shall begin on Date of Substantial Completion.

1.8 COORDINATION

- A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Basis-of-Design Product: The designs for roof specialties are based on the products named. Subject to compliance with requirements, provide either the named products or comparable products.

2.2 EXPOSED METALS

- A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold rolled, mill finished.
- B. Aluminum Sheet: **ASTM B 209** (**ASTM B 209M**), alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
 - 1. Surface: Smooth, flat finish.

2. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than **70** percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with **AAMA 2605** and with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **As selected by Architect from full range of industry colors and color densities.**
- C. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 1. Anodic Finish: Apply the following finish:
 - a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. 2B (bright, reflective) finish.

2.3 CONCEALED METALS

- A. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Wood Nailers: Preservative-treated wood.
- C. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric 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 C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- I. Polyethylene Sheet: **6-mil- (0.15-mm-)** thick polyethylene sheet complying with ASTM D 4397.
- J. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m).**

2.5 ROOF EDGE FLASHINGS

- A. Canted Roof Edge Fascia: Manufactured, two-piece, roof edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding **12 feet (3.6 m)** and a continuous formed galvanized steel sheet cant dam, **0.028 inch (0.7 mm)** thick, minimum, with integral drip edge cleat. Provide matching mitered and welded corner units.
 - 1. Available Manufacturers:
 - a. MM Systems Corporation.
 - 2. Available Products:
 - a. SLF-Series I Extruded, Extender & Soffit Closure.
 - 3. Fascia Cover: Fabricated from the following exposed metal:
 - a. Extruded Aluminum: **0.040 inch (1.0 mm)** thickness (minimum).
 - 4. Fascia Cover Color: As selected by Architect.
 - 5. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 6. Fascia Accessories: Fascia extenders with continuous extruded soffit trim.
 - 7. Provide extenders as needed so as to match the existing fascia profile, geometry, etc.

2.6 COUNTERFLASHINGS

- A. Counterflashings: Manufactured units in lengths not exceeding **12 feet (3.6 m)** for insertion into existing mortar joints and compress against base flashings with joints lapped, from the following exposed metal in thickness indicated:
 - 1. Copper: **16 oz./sq. ft. (0.55 mm thick).**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 - 1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
 - 1. Install manufactured roof specialties with provisions for thermal and structural movement.
 - 2. Torch cutting of manufactured roof specialties is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of stainless-steel manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.
- D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
- E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (450 mm) of corners or intersections.

- F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- G. Seal joints with sealant as required by manufacturer of roofing specialties.

3.3 ROOF EDGE FLASHING INSTALLATION

- A. Install cleats, cant dams, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings to resist uplift and outward forces according to performance requirements.
- C. Install roof edge flashing per manufacturer's written instructions. Make weathertight fit, allowing for expansion and contraction as recommended by manufacturer's written instructions.

3.4 COUNTERFLASHING

- A. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in existing mortar joints (after removal of mortar) and fit tightly to base flashings. Extend counterflashings 4 inches (100 mm) over base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant. Repoint mortar joints (see Section 04012).

3.5 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 manufactured 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 in a clean condition during construction.
- D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7100

SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
 - 1. Be a member in good standing of the Fire Stop Contractors International Association
 - 2. Licensed by a state or local authority, where applicable
 - 3. Approved by the Universities Fire Marshal for each specific Job
 - 4. Shown to have successfully completed not less than 5 comparable size projects.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

- C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Hilti, Inc.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire-barrier walls.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include floors.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- H. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- I. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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 - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Firestop Systems with No Penetrating Items: Comply with the following:
 1. Available UL-Classified Systems:
 - a. C-AJ-0001-0999.
 - b. W-L-0001-0999.

2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Mortar.
- B. Firestop Systems for Metallic Pipes, Conduit, or Tubing: Comply with the following:
 1. Available UL-Classified Systems:
 - a. C-AJ-1001-1999.
 - b. W-L-1001-1999.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Mortar.
- C. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing: Comply with the following:
 1. Available UL-Classified Systems:
 - a. C-AJ-2001-2999.
 - b. W-L-2001-2999.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Intumescent wrap strips.
 - e. Firestop device.
- D. Firestop Systems for Electrical Cables: Comply with the following:
 1. Available UL-Classified Systems:
 - a. C-AJ-3001-3999.
 - b. W-L-3001-3999.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Silicone foam.
- E. Firestop Systems for Cable Trays: Comply with the following:
 1. Available UL-Classified Systems:
 - a. C-AJ-4001-4999.
 - b. W-L-4001-4999.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Silicone foam.
- F. Firestop Systems for Insulated Pipes: Comply with the following:
 1. Available UL-Classified Systems:
 - a. C-AJ-5001-5999.
 - b. W-L-5001-5999.
 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.

- c. Silicone foam.
 - d. Intumescent wrap strips.
- G. Firestop Systems for Miscellaneous Electrical Penetrants: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-6001-6999.
 - b. W-L-6001-6999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Mortar.
- H. Firestop Systems for Miscellaneous Mechanical Penetrations: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-7001-7999.
 - b. W-L-7001-7999.
 - 2. Type of Fill Materials: One or both of the following:
 - a. Latex sealant.
 - b. Mortar.
- I. Firestop Systems for Groupings of Penetrations: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-8001-8999.
 - b. W-L-8001-8999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Mortar.
 - c. Intumescent wrap strips.
 - d. Firestop device.
 - e. Intumescent composite sheet.
- J. Smoke-stop Systems
 - 1. For all non-rated partitions required to control smoke only provide the following:
 - a. Mineral wool
 - b. Fire and smoke stopping sealant

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joints at exterior curtain-wall/floor intersections.
- B. Related Sections:
 - 1. Section 07 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:

- a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 - 2. Basis of Design Manufacturer: Hilti
 - a. Product:
- C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- E. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support 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 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.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 2. Apply fill materials so they contact and adhere to substrates formed by joints.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint 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 - Fire-Resistive Joint System - 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.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance
- B. Directory" under product Category XHBN
 1. Floor-to-Floor (Concrete to Concrete Floor), Fire-Resistive Joint System:
 - a. Basis-of-Design UL-Classified Product: FF-D -0005.
 - 1) Assembly Rating: 2 hours.
 - 2) Nominal Joint Width: 1-inch
 - 3) Movement Capabilities: Class II - 12.5 percent compression or extension.
 2. Head-of-Wall (Steel Stud/Gypsum Board Wall to Concrete Floor Slab with or without Metal Deck), Fire-Resistive Joint System:
 - a. Basis-of-Design UL-Classified Product: HW-D -0043.
 - 1) Assembly Rating: 2 hours.

- 2) Nominal Joint Width: 1-inch
- 3) Movement Capabilities: Class II - 18.75 percent compression and extension.

C. Directory" under product Category XHDG.

D. Perimeter Fire-Resistive Joint Systems

1. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.
 - a. Perimeter Fire-Containment System (Steel Stud/Gypsum Board Wall to Concrete Floor Slab with or without Metal Deck), Fire-Resistive Joint System:
 - 1) Basis-of-Design UL-Classified Product: CW-S-1002.
 - 2) Integrity Rating: 2 hours.
 - 3) Insulation Rating: ¼-hour.
 - 4) Linear Opening Width: 2-1/2 inches, maximum.

END OF SECTION 078446

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Latex joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.5 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 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: 10 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors of Exposed Joint Sealants: Match Architect's samples.

2.2 SILICONE JOINT SEALANTS

- A. 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 C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Basis of design Manufacturer: Dow Corning
 - a. Product: 756 SMS Building Sealant

2.3 MILDEW-RESISTANT JOINT SEALANTS

- A. 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 C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Basis of design Manufacturer: Dow Corning
 - a. Product: 786 Silicone Sealant

2.4 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Manufacturer: Pecora Corporation
 - a. AC-20 + Silicone.

2.5 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 1. Manufacturer: BASF
- B. Cylindrical Sealant Backings: ASTM C 1330, 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.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 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, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 3. 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 of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
- G. 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.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
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, windows and elevator entrances.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: Match Architects Sample.
- B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: Match Architects Sample

END OF SECTION 079200

SECTION 081213 - HOLLOW METAL 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. Interior hollow-metal frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation 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. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, **fire-resistance ratings**, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each frame type.
 - 2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Locations of reinforcement and preparations for hardware.
 - 4. Details of each different wall opening condition.
 - 5. Details of anchorages, joints, field splices, and connections.
 - 6. Details of accessories.
- C. Samples for Verification:

1. Fabrication: Prepare Samples to demonstrate compliance with requirements for quality of materials and construction. Show profile, corner joint, floor and wall anchors, and silencers.
- D. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of **fire-rated hollow-metal frame assembly** for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal frames vertically under cover at Project site with head up. Place on minimum **4-inch- (102-mm-)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ceco Door.
- B. Curries Company.
- C. National Custom Hollow Metal Doors & Frames.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 STEEL FRAMES

- A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Interior Frames: SDI A250.8, Level 2.
 - 1. Materials: **Metallic-coated** steel sheet, minimum thickness of **0.053 inch (1.3 mm)** (nominal 16 gauge).
 - 2. Construction: **Full profile welded**.
 - 3. Exposed Finish: **Prime**.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each **24 inches (610 mm)** of frame height above **7 feet (2.1 m)**.
 - 3. Postinstalled Expansion Anchor: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A 879/A 879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. 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 hollow-metal frames of type indicated.
- F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. 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 welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with **SDI A250.11**.

- B. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - 1. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - 2. Install frames with removable stops located on secure side of opening.
- C. Fire-Rated Openings: Install frames according to NFPA 80.
- D. Floor Anchors: Secure with postinstalled expansion anchors.
- E. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. **Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.**
- F. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - 1. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.

3.3 CLEANING AND TOUCHUP

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081213

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Solid-core doors with wood-veneer faces.
 2. Factory finishing flush wood doors.
 3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Dimensions and locations of blocking.
 2. Dimensions and locations of mortises and holes for hardware.
 3. Dimensions and locations of cutouts.
 4. Undercuts.
 5. Requirements for veneer matching.
 6. Doors to be factory finished and finish requirements.
 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc.
 2. Eggers Industries.
 3. Marshfield Door Systems, Inc. Signature Series – Basis of Design

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Fire-Rated Wood Doors: Doors 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 NFPA 252 or UL 10C.
1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 475 lbf (2110 N) per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Exposed Vertical Edges: Same species as faces - edge Type A.
7. Core: Particleboard or mineral core as needed to provide fire-protection rating indicated.
8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.

- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-6 catalyzed polyurethane.
 - 3. Staining: Match existing doors.
 - 4. Sheen: Match existing doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors. Provide **1/8 inch (3.2 mm)** from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide **1/4 inch (6.4 mm)** from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock and hinge edges.
 - 2. Bevel fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 084413 – ALUMINUM CURTAIN WALLS

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: Basis of Design: Kawneer Architectural Aluminum Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.
 - 1. Types of Kawneer Aluminum Curtain Wall include:
 - a. 1600 LR Wall™ Curtain Wall System 2-1/2" x 5-3/4" (63.5 x 184.2), outside glazed pressure plate system.

1.3 Definitions

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

- A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Loosening or weakening of fasteners, attachments, and other components.
 - d. Failure of operating units.
- B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind loads: Refer to Wind Design Data on Drawing S800.
- D. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft² (0.3 l/s · m²) at a static air pressure differential of 6.24 psf (300 Pa).
- E. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.
- F. Water Resistance, (dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.
- G. Uniform Load: A static air design load of 30 psf (1437 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At 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% of their clear spans shall occur.
- H. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.
- I. Energy Efficiency:
 - 1. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than 0.38.

- J. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
1. Captured - 69_{frame} and 57_{glass} (clear)

1.5 Submittals

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work. Shop drawings shall be stamped by a Professional Engineer licensed to practice in New York State.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed curtain wall systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
 1. Joinery
 2. Glazing

1.6 Quality Assurance

- A. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed performance requirements.
- C. Source Limitations: Obtain aluminum curtain wall system through one source from a single manufacturer.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.7 Project Conditions

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 Warranty

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 2. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Basis-of-Design Product:
 1. Kawneer Company, Inc.
 2. 1600 LR Wall™ Curtain Wall System.

3. Frame depth options: 2-1/2" x 5-3/4" (63.5 x 184.2), outside glazed pressure plate system. Tested to AAMA 501.

2.2 Materials

- A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
- B. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.
- C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Pressure Plate: Pressure plate shall be aluminum and fastened to the mullion with stainless steel screws.
- F. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- G. Sealant: For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- H. Thermal Improvement: Thermal separator shall be extruded of a silicone compatible elastomer rubber that provides a minimum 3/16" separation.
- I. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Curtain Wall Framing

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Glazing System: 4 sided captured.
 2. Glazing Plane: Front.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
- C. Framing Sealants: Shall be suitable for glazed aluminum curtain wall as recommended by sealant manufacturer.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- E. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- F. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- G. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle curtain wall material and components to avoid damage. Protect curtain wall material against damage from elements, construction activities, and other hazards before, during and after installation.

2.4 Glazing

- A. Glazing: See Section 08 8000.
- B. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: As recommended by manufacturer for joint type.

2.5 Operable Units

- A. Windows: Comply with Division 08 Section "Aluminum Windows".

2.6 Fabrication

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 7. Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- C. Curtain Wall Framing: Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.
- D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
 - 1. Kawnear Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color to match existing frames on First Floor of Connector).

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. General: Install curtain wall systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.
 - 1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
 - 2. Glazing: Glass shall be outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9" (228.6) on center.
 - 3. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

3.3 Field Quality Control

- A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
 - 1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
 - a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft², whichever is greater.
 - b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).
- B. Manufacturer's Field Services: Provide periodic site visits by manufacturer's field service representative. Submit field service representative's inspection report to Owner, Contractor, and Architect.

3.4 Adjusting, Cleaning and Protection

- A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
- B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 4413

SECTION 085113 – ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes: Basis of Design: Kawneer Architectural Aluminum Windows including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of window units.
 - 1. Types of aluminum windows include:
 - a. Kawneer Series AA™5450 Ultra Thermal (Standard Face).
 - b. Side load double hung (AW-PG65-H).

1.3 DEFINITIONS

- A. Performance class designations according to AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS):
 - 1. AW: Architectural Window
- B. Performance grade number according to AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS):
 - 1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.
- C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- D. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).
- E. Minimum Test Size: Smallest gateway test size permitted for performance class. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
 - 1. Size required by AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) for minimum gateway performance.
 - 2. Test size: 60" x 99"
- B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for the Project that pass AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS), Uniform Load Structural Test:
 - 1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade.
 - a. Basic Wind Speed (MPH): See Drawing S800.
 - b. Importance Factor (I, II, III): See Drawing S800.
 - c. Exposure Category (A,B,C,D): See Drawing S800.
 - 2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on

- testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS), Uniform Load Deflection Test or structural computations.
- C. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the maximum change in ambient and surface temperatures in the project's location by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- D. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, with a CRF not less than 71 (frame) and 76 (glass).
- E. Temperature Index (I): Provide aluminum windows tested for thermal performance according to CSA-A440 with a Temperature Index not less than 40 (frame), 74 (glass).
- F. Energy Efficiency:
1. Thermal Transmittance Test (U-Factor): When tested to AAMA specification 1503, AAMA specification 507 or NFRC 100 the thermal transmittance (U-Factor) shall not be more than:
 - a. Fixed fenestration: 0.36.
 - b. Operable fenestration: 0.43.
- G. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC as determined according to NFRC 200 and AAMA 507 procedures.
- H. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS), Air Infiltration Test.
1. Maximum Rate: **0.3 cfm/sq. ft. (0.5 L/s•m²)** of area at an inward test pressure of **6.24 lbf/sq. ft. (300 Pa)** in accordance with ASTM E283.
- I. Water Resistance: No water leakage as defined in AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) referenced test methods at a water test pressure equaling that indicated, when tested according to ASTM E547 and ASTM E331.
- Test Pressure: 20 percent of positive design pressure, but not more than **10 lbf/sq. ft. (478 Pa)** with a **10 lb. sill** or **15 lbf/sq. ft. (720 Pa)** with a **15 lb. sill**.
- J. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.
- K. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
- L. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) for operating window types indicated.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances and installation details.

- C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
- D. Samples for Verification: For aluminum windows and components required.
- E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.
- G. Maintenance Data: For operable sash, operating hardware and finishes to be include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of aluminum framed window openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 - 1. Warranty Period: Two (2) years from Date of Substantial.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product:
 - 1. Kawneer Company Inc.
 - 2. Series AA™5450 Ultra Thermal Double Hung (Standard Face)
 - 3. 4 5/8" (117.48 mm) frame depth
 - 4. Side load double hung (AW-PG65-H).

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW

- A. Window Type: Double Hung Window.
- B. Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS)
 - 1. Performance Class and Grade: AW-PG65-H

2.4 GLAZING

- A. Glass and Glazing Materials: See Section 08 8000.
- B. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer's standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type glazing beads and an interior gasket in accordance with AAMA 702 or ASTM C864.

2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash weight and dimensions.
- B. Double Hung Windows: Provide the following operating hardware:
 - 1. Sash Balances: A Class 5 adjustable spiral balance with stainless steel or other corrosion-resistant components. Two per sash.
 - 2. Handle: Continuous, integral, bottom and top sash lift handle.
 - 3. Sash Lock: White bronze sweep lock and keeper on meeting rails. One or two per sash as required by size. Brushed nickel finish.
 - 4. Aluminum autolock at top sash lift handle.

5. Limit Device: Sash stop limit device; for bottom and top sash located at jamb; two per sash. Locate as directed by Owner.

2.6 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on outside of window and provide for each operable exterior sash. Do not provide screens at Rescue Windows.
 1. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners and removable PVC spline.
 1. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch (1.3-mm) wall thickness.
 2. Finish: Manufacturer's standard.
- C. Aluminum Wire Fabric: 18-by-16 mesh/inch (18-by-16 mesh/25.4mm) of 0.011-inch (0.28-mm) diameter, coated aluminum wire.
 1. Wire-Fabric Finish: Charcoal Grey.

2.7 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fit joints; make joints flush, hairline and weatherproof.
 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- B. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- C. Fabricate aluminum windows that are re-glazable without dismantling sash or framing.
- D. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact. Thermal barriers shall be designed in accordance with AAMA TIR A8.
 1. Frame thermal barrier shall be polyamide with a minimum of 1" (25.4 mm) separation, installed continuously and mechanically bonded to the aluminum.
 2. Sash thermal barrier shall be polyamide with a minimum of 1/2" (12 mm) separation, installed continuously and mechanically bonded to the aluminum.
- E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash.
- F. Weep Holes: Provide weep holes and internal passages in window frames to conduct infiltrating water to exterior.

- G. Provide water-shed members as required above lines of natural water penetration.
- H. Mullions: Provide mullions and cover plates as indicated (if not indicated, provide as required for a complete installation), matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design loads of window units.
- I. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch (2.4-mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.
- J. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
- K. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
 - 1. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color to Match Existing Frame Color from Lower-Level Window Frames).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight window installation.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
 - 3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install aluminum framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- D. Install aluminum framed window systems and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing Standard shall be per AAMA 502 including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 for Water Penetration Test.
 - a. Air Infiltration Test: Conduct test in accordance with ASTM E 783 at a minimum uniform static test pressure of 1.57 psf (75 Pa) for CW or 6.24 psf (300 Pa) for AW. The maximum allowable rates of air leakage for field testing shall not exceed 1.5 times the project specifications.
 - b. Water Infiltration Test: Water penetration resistance tests shall be conducted in accordance with ASTM E 1105 at a static test pressure equal to 2/3 the specified water test pressure.
 - 2. Testing Extent: Architect shall select window units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present.
 - 3. Test Reports: Shall be prepared according to AAMA 502.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 08 5113

SECTION 08 71 00 – DOOR HARDWARE

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. Mechanical door hardware for:
 - a. Swinging doors.

1.03 REFERENCES

- A. UL - Underwriters Laboratories
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Key Systems and Nomenclature
- C. ANSI - American National Standards Institute
 - 1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
- D. Comply with New York State Education Department 1998 Edition of the Manual of Planning Standards, Section S105 – Door Hardware and NFPA 101-Life Safety Code.

1.04 SUBMITTALS

- A. General:
 - 1. Submit in accordance with Division 01 requirements.
 - 2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: For each item of hardware indicated furnish manufacturer's catalog sheets highlighting information pertaining specifically to product (s) submitted. Include manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: Submit production sample of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule if requested.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door and frame sizes, materials and door swings.
 - b. Door Index; include door number, heading number, and Architects hardware set number.
 - c. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - d. Type, style, function, size, and finish of each hardware item.
 - e. Name and manufacturer of each item.
 - f. Fastenings and other pertinent information.
 - g. Location of each hardware set cross-referenced to indications on Drawings, i.e., Corridor to Classroom
 - h. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - i. Mounting locations for hardware.
 - j. Name and phone number for local manufacturer's representative for each product.
 - k. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
4. Key Schedule:
 - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
 - a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule, edited to reflect conditions as-installed.
 - f. Final keying schedule
 - g. Copies of floor plans with keying nomenclature
 - h. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- C. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.

5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
- J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Attendees: Owner, Contractor, Architect, Installer, and Supplier's Architectural Hardware Consultant.
 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- K. Pre-installation Conference: Conduct conference at Project site
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Inspect and discuss preparatory work performed by other trades.
3. Review required testing, inspecting, and certifying procedures.

L. Coordination Conferences:

1. Installation Coordination Conference: After delivery of, but before installation of the hardware, the General Contractor/Construction Manager shall coordinate and schedule a hardware installation seminar. The seminar will be conducted on the installation of locksets, door closers, exit devices, overhead stops and electromechanical or electromagnetic hardware. The manufacturer's representative for each of the above product categories shall conduct the meeting. The seminar shall be conducted at the job site with installers of hardware on wood, hollow metal and aluminum doors (including any installer working with low voltage wiring on electromechanical hardware) in attendance. Seminar will provide training for installation using installation instructions, hardware schedules, templates and physical product samples.
 - a. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. No concession on the quality of material or quality of application shall be allowed due to non-timely procurement of hardware.
- E. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years for LCN 4000 series
 - b. Locksets:
 - 1) Mechanical: 10 years for Schlage ND series
 - 2) Mechanical: 3 years for Schlage L9000 series
 - c. Key Blanks: Lifetime

1.09 MAINTENANCE

- A. Maintenance Tools:
 - 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Requests for material substitution of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category must be submitted to the Architect, Owner, and/or Owner's Agent 10 days prior to bid date. Requests for substitution are to be submitted in writing and are to be accompanied by physical samples. Requests for substitution shall contain written certification from factory that proposed items meet all performance criteria delineated in this document.

- B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect’s approval.

2.02 MATERIALS

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 - 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
- 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 CONTINUOUS HINGES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Select
 - 2. Acceptable Manufacturers and Products: Roton, Ives
- B. Continuous hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- C. Continuous, gear-type hinges: extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.04 HINGES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 5BB1HW series
- 2. Acceptable Manufacturers and Products: Stanley FBB168 series

B. Requirements:

1. Provide five-knuckle, bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
9. Provide mortar guard for each electrified hinge specified.

2.05 EXIT DEVICES AND AUXILIARY ITEMS

- A. Scheduled Manufacturer and Product: Von Duprin 99 Series (No Substitution)
- B. Exit devices and auxiliary items: BHMA A156.3, Grade 1
- C. Requirements:
 1. All exposed finishes to be Dull Chrome.
 2. Lever handle trim to be heavy duty vandal resistance to match lock trim.
 3. Keyed cylinder dogging at all non-rated exterior door devices unless otherwise noted.
 4. Provide shim kits as required for door lites.

2.06 MORTISE LOCKS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product: Schlage L9000 series
 2. Acceptable Manufacturers and Products: Corbin Russwin ML2000 Series
- B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Indicators: Where specified, provide indicator window measuring a minimum 2 inch x 1/2 inch with 180 degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
 - a. Occupied Indicator: Provide indicator above cylinder for visibility while operating the lock that identifies the trim as occupied/unoccupied status of the door. Indicator in unoccupied state has a white background with black text and icon. Indicator in the occupied state has a red background with white text and icon.
3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: Schlage 03A.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.07 MECHANICAL LOCKS AND LATCHES

- A. Manufacturers and Products: Schlage ND Series TLR (No Substitution)
- B. Bored locks BHMA A156.2; Grade 1: Series 4000
- C. Lock functions: as indicated in door hardware schedule.
- D. Lock throw: comply with testing requirements for length of bolts required for labeled fire doors and as follows:
 1. Bored Locks: minimum 1/2-inch latchbolt throw
 2. Mortise locks: minimum of 3/4-inch latchbolt throw
- E. Lock backset: 2-3/4 inches, unless otherwise indicated
- F. Lock trim:
 1. Description: as indicated in door hardware schedule
 2. Levers: Zinc alloy
 3. Escutcheons (Roses): wrought
- G. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

2.08 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage (No Substitution)

B. Requirements:

1. Provide interchangeable cylinders/cores to match Owner's existing Schlage key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.09 KEYING

- ### A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

- ### B. Provide cylinders/cores keyed into Owner's existing factory registered Schlage keying system in Everest D/T and Everest Primus, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Master Keying system as directed by the Owner.
2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.

- a. Change (Day) Keys: 3 per cylinder/core.
- b. Permanent Control Keys: 3.
- c. Master Keys: 6.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4010/4110 series (No Substitution)

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Covers: Metal
9. Pressure Relief Valve (PRV) Technology: Not permitted.
10. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
11. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled with countersunk screw holes. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

- c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.12 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

- 1. Scheduled Manufacturers: Glynn-Johnson
- 2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

- 1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
- 2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
- 3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
- 4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.13 DOOR STOPS AND HOLDERS

A. Manufacturers:

- 1. Scheduled Manufacturer: Ives
- 2. Acceptable Manufacturers: Rockwood

B. Provide door stops at each door leaf:

- 1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
- 2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
- 3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.14 GASKETING

A. Manufacturers:

- 1. Scheduled Manufacturer: Zero International
- 2. Acceptable Manufacturers: National Guard, Reese

B. Requirements:

- 1. Provide gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.

2.15 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Protection Plates: BHMA 630 (US32D)
3. Overhead Stops and Holders: BHMA 630 (US32D)
4. Door Closers: Powder Coat to Match
5. Wall Stops: BHMA 630 (US32D)
6. Weatherstripping: Clear Anodized Aluminum
7. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Lock Cylinders:
 - 1. Furnish permanent cores to Owner for installation.
- H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- J. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

3.04 FIELD QUALITY CONTROL

- A. The manufacturer's representative(s) for the locking devices and closing devices shall inspect and approve the installation of the products whose manufacturer they represent. Incorrectly installed hardware must be reported to the Architect before preparation of the final punch list.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.08 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

- B. Hardware Codes:

100	1 ea.	continuous hinge SL-24HD Clear Anodized
101	1 ea.	continuous hinge, wide throw SL-40HD Clear Anodized
201	1 ea.	closer (push side) 4111EDA MC AL x TB
201A	1 ea.	closer (push side) 4111EDA x ST-2456 MC AL x TB with long arm for door swing beyond 95 degrees on D/E frame
300	1 ea.	surface vertical rod exit device 9927L-F x 996L x 03 LBR US26D SNB
301	1 ea.	surface vertical rod exit device 9927EO-F LBR US26D x SNB (Exit Only)
302	1 ea.	surface vertical rod exit device 9927L-F-BE x 996L x 03 LBR US26D SNB

(No cylinder, lever always operable)

Note: LBR = less bottom rod - spring loaded auxiliary latch bolt must be installed in lower door edge

400	1 ea.	LFIC rim cylinder 20-057 626 with construction core
400A	1 ea.	permanent keyed core Everest 626
507	1 ea.	recessed magnetic door holder SEM-7850 AL
507A	1 ea.	surface mounted magnetic door holder SEM-7830 AL
507B	1 ea.	floor mounted magnetic door holder SEM-7820 AL
600	1 ea.	kick plate 8400 - 10"H x 2"LDW @ Single Drs., 10" x 1"LDW @ Pair Doors .050 US32D (Standard with B4E x countersunk screw holes B-CS)
700A	1 ea.	smoke seal S771C for meeting stile
701	1 set	smoke seal 316AS x Tek for H&J

C. Hardware Sets (Doors/Codes):

<u>SET 1</u>	
2-100 (2)	2/100-2/201-2/300-2/400-2/400A-507-507B-2/600-700A-701
<u>SET 2</u>	
1-200 (2)	2/101-2/201A-2/301-507A-507B-2/600-700A-701
2-300 (2)	2/101-2/201A-2/301-507A-507B-2/600-700A-701
<u>SET 3</u>	
2-200 (2)	2/101-2/201A-2/301-507-507B-2/600-700A-701
<u>SET 4</u>	
1-100 (2)	2/101-2/201A-2/301-2/507B-2/600-700A-701
1-300 (2)	2/101-2/201A-2/301-2/507B-2/600-700A-701
<u>SET 5</u>	
3-200 (2)	2/100-2/201-2/302-2/507B-2/600-700A-701
3-300 (2)	2/100-2/201-2/302-2/507B-2/600-700A-701

END OF SECTION 08 7100

SECTION 08 8000 – GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass for exterior window and curtain wall.
 - 2. Glazing sealants and accessories.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. ASTM C 1036 also includes traditional thickness designations in IP units, but the actual thickness is based on the equivalent IP designation in millimeters.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- D. BCNYS: Building Code of New York State.
- E. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: of each type of glazing required: 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations as indicated on Drawings.
- D. Delegated-Design Submittal: For glass 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 and manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating 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. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer 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 C 1021 to conduct the testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to 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.

1.8 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.
- B. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.9 WARRANTY

- A. 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 the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. PPG Industries, Inc.
 2. Guardian Industries (Basis of Design).
 3. Pilkington.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Obtain reflective-coated glass from single source from single manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 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 the following: 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: per all applicable codes.
 2. 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.
 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

- E. 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 6 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 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. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. 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. 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 IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: 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.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- D. Reflective-Coated Vision Glass: ASTM C 1376.
- E. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.7 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. Field-applied sealants shall have a VOC content of not more than 250 g/L.
 - 4. Colors of Exposed Glazing Sealants: Match Architect's samples.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Dow Corning Corporation.

2.8 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 C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of 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: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 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

3.1 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.

3.2 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.

3.3 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 according to 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 by gasket manufacturer.

3.4 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.

3.5 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 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 by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 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.

3.7 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 come into 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.

3.8 MONOLITHIC GLASS SCHEDULE

A. **Glass Type G-1:** Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

A. **Glass Type IG-1:** Low-E-coated, insulating glass.

1. Basis-of-Design Product: Product: Guardian, SunGuard, SNX 62/27.
2. Conformance: ASTM E 2190.
3. Overall Unit Thickness: 1 inch.
4. Minimum Thickness of Each Glass Lite: 6 mm.
5. Outboard-Inboard Substrate: Clear-Clear, fully tempered float glass.
6. Appearance: Clear.
7. Interspace Content: Argon.
8. Low-E Coating: Sputtered on second surface.
9. Glass Unit Performance Characteristics:
 - a. Visible Light Transmittance: 64 percent.
 - b. Visible Light Reflectance Out: 11 percent.
 - c. Visible Light Reflectance In: 12 percent.
 - d. Winter U-Value Nighttime: 0.24.
 - e. Solar Heat Gain Coefficient: 0.27
 - f. Relative Heat Gain: 48.
10. Safety glazing required.
11. Edge Seals: ASTM E 2188, with aluminum spacers, dual-sealed with a primary seal of polyisobutylene and a secondary seal of silicone sealant for glass-to-spacer seals.
12. Sealant: Approved by glass manufacturer.
13. Application: exterior windows and curtain wall.

END OF SECTION 08 8000

SECTION 08 8110 - FIRE-RATED GLASS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-rated glazing materials installed as vision lights in fire-rated doors.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
 - 2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings
- C. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- D. Glass Association of North America (GANA):
 - 1. GANA – Glazing Manual.
 - 2. FGMA – Sealant Manual.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 80: Fire Doors and Windows.
 - 2. NFPA 252 – Fire Tests of Door Assemblies.
 - 3. NFPA 257 – Fire Tests of Window Assemblies.
- F. Underwriters Laboratories, Inc. (UL):
 - 1. UL 9 – Fire Tests of Window Assemblies.
 - 2. UL 10B – Fire Tests of Door Assemblies.
 - 3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Fire-rated glass ceramic clear and wireless glazing material with surface-applied film listed for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with required hose stream test.

1.4 SUBMITTALS

- A. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- B. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for

glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

- C. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- D. Samples: Submit, for verification purposes, two 8-inch by 10-inch samples for each type of glass indicated.

1.5 QUALITY ASSURANCE

- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or other certification agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials per manufacturer's written instructions.
- B. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.
- C. Store off ground, under cover, protected from weather and construction activities.

1.7 WARRANTY

- A. Provide manufacturer's warranty.
- B. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS

- A. Product: FireLite® NT as supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, web site www.fireglass.com, or equivalent.
- B. Properties:
 - 1. Thickness: 3/16 inch FireLite®.
 - 2. Film: Fire-rated surface film as approved by manufacturer.
 - 3. Weight: 2.4 lbs./sq. ft.
 - 4. Approximate Visible Transmission: 88 percent.
 - 5. Approximate Visible Reflection: 9 percent.
 - 6. Hardness (Vicker's Scale): 700.

7. Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.
8. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Category II).
9. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
10. Surface Finish:
 - a. Premium Grade-Ground and polished on both sides.

- C. Maximum sheet sizes based on surface finish:
 1. Premium: 48 inches by 96 inches.
- D. Labeling: Permanently label each piece of FireLite® NT with the FireLite® logo, UL logo and fire rating.
- E. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00 and ASTM E2010-01; NPFA 252 and NFPA 257; UL 9, UL 10B and UL 10C.

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
- B. Glazing Compound: DAP 33 putty.
- C. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
 1. Dow Corning 795 - Dow Corning Corp.
 2. Silglaze-II 2800 - General Electric Co.
 3. Spectrem 2 - Tremco Inc.
- D. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
- E. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.3 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 2. Minimum required face or edge clearances.
 3. Observable edge damage or face imperfections.

- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 INSTALLATION (GLAZING)

- A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- E. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.
- F. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- G. Place glazing tape on free perimeter of glazing in same manner described above.
- H. Install removable stop and secure without displacement of tape.
- I. Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.
- J. Install in vision panels in fire-rated doors to requirements of NFPA 80.
- K. Install so that appropriate UL and FireLite® NT markings remain permanently visible.

3.3 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08 8110

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, firestop tracks, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.027 inch.
 - b. Depth: As indicated on Drawings.
 - 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.025 inch.
 - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.027 inch.
- G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.033 inch.
 2. Depth: As indicated on Drawings.
- I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical.
- J. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

- a. Type: Postinstalled, expansion anchor.
- 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 2 inches.
- E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where

offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

- a. Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Do not attach hangers to steel roof deck.
 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092613 - GYPSUM VENEER PLASTERING

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. Gypsum veneer plaster over interior masonry surfaces.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show locations, fabrication, and installation of control joints, reveals, and trim; include plans, elevations, sections, details of components, and attachments to other work.
- C. Samples: For the following products:
 - 1. Textured Finishes: **Manufacturer's standard size** for each textured finish and on rigid backing.

1.4 QUALITY ASSURANCE

- A. Mockups: Provide a full-thickness finish mockup for each type and finish of gypsum veneer plaster and substrate to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select representative surfaces and conditions for application of each type of gypsum veneer plaster and substrate.
 - 2. Provide mockups of in sizes of at least 100 sq. ft. (9 sq. m).
 - 3. Apply gypsum veneer plaster, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

- B. Store materials inside under cover, and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
- C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.
- B. Room Temperatures: Maintain not less than 55 deg F (13 deg C) or more than 80 deg F (27 deg C) for seven days before application of gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
- C. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - 1. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - 2. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
 - 3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
- D. Do not install panels that are wet, moisture damaged, mold damaged, or faded from overexposure to sunlight.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and 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

2.1 MANUFACTURERS

- A. Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, joint reinforcing tape, and embedding material, from single manufacturer.

2.2 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.

2.3 GYPSUM VENEER PLASTER

- A. Two-Component Gypsum Veneer Plaster: ASTM C587, with separate formulations; one for base-coat application and one for finish-coat application over substrates.
 - 1. Base Coat.
 - 2. Smooth Finish Coat.

2.4 TRIM ACCESSORIES

- A. Standard Trim: ASTM C1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
 - 1. Material: **Galvanized-steel sheet, aluminum-coated steel sheet, or rolled zinc.**
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives veneer plaster.
 - d. L-Bead: L-shaped; exposed long flange receives veneer plaster.
 - e. U-Bead: J-shaped; exposed short flange does not receive veneer plaster.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.
 - g. Control joints.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Aluminum: Alloy and temper with not less than the strength and durability properties of **ASTM B221 (ASTM B221M)**, Alloy 6063-T5.
 - 2. Finish: Corrosion-resistant primer compatible with veneer plaster.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
- B. Bonding Agent: ASTM C631 polyvinyl acetate.
- C. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.
- D. Patching Mortar: Dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a **No. 16 (1.18-mm)** sieve, using only enough water for handling and placing.

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. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Masonry Substrates: Verify that mortar joints are struck flush.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Masonry Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - 1. Clean surfaces to remove dirt, grease, oil, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - 2. Apply bonding agent on dry masonry substrates.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: Install trim with back flanges intended for fasteners, and attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install **according to ASTM C844 and in specific locations approved by Architect.**
- C. Trim: Install in the following locations:
 - 1. Bullnose Bead: Use **at outside corners.**
- D. Aluminum Trim:
 - 1. Apply and embed joint tape over flanges of aluminum trim accessories if recommended by trim manufacturer.

3.4 GYPSUM VENEER PLASTERING

- A. Bonding Agent: Apply bonding agent on dry **masonry** according to gypsum veneer plaster manufacturer's written recommendations.
- B. Gypsum Veneer Plaster Mixing: Mechanically mix gypsum veneer plaster materials to comply with ASTM C843 and with gypsum veneer plaster manufacturer's written recommendations.

- C. Gypsum Veneer Plaster Application: Comply with ASTM C843 and with veneer plaster manufacturer's written recommendations.
1. Two-Component Gypsum Veneer Plaster:
 - a. Base Coat: Hand trowel or machine apply base coat over substrate to a uniform thickness of **1/16 to 3/32 inch (1.6 to 2.4 mm)**. Fill voids and imperfections.
 - b. Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to a uniform thickness of **1/16 to 3/32 inch (1.6 to 2.4 mm)**.
 2. Where gypsum veneer plaster abuts metal, including doorframes, windows and other units, groove finish coat to eliminate spalling.
- D. Concealed Surfaces: Do not omit gypsum veneer plaster behind cabinets, furniture, furnishings, and similar removable items. Omit veneer plaster in the following areas where it will be concealed from view in the completed Work unless otherwise indicated or required to maintain fire-resistance and STC ratings:
1. Above suspended ceilings.
 2. Behind wood paneling.
- E. Gypsum Veneer Plaster Finish: **Match existing.**

3.5 PROTECTION

- A. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.
- B. Remove and replace gypsum veneer plaster and gypsum base panels that are wet, moisture damaged, or mold damaged.
1. Indications that gypsum base panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 2. Indications that gypsum base panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2613

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 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.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 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 E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 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.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. USG Corporation.
 - 2. Georgia Pacific
 - 3. National Gypsum
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8", unless noted otherwise.
- C. Gypsum Wallboard: Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8", unless noted otherwise.
- D. Moisture and Mold-Resistant Abuse Resistant Gypsum Board: With moisture, mold-and impact resistant surfaces.complying with ASTM C473 and D3273
 - 1. Basis of design product: USG Mold Tough AR Firecode X Panels
 - 2. Impact Resistance: Level 2 per ASTM C1629
 - 3. Core: 5/8 inch, Type X.
 - 4. Long Edges: Tapered.
 - 5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274
- E. Impact-Resistant Gypsum Board with polycarbonate backer per ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. USG Corporation.
 - b. Georgia Pacific
 - c. National Gypsum
 - d. Nudo: Secure Sheild
 - e. Pinnacle Armor: Corguard
 - 2. Core: 5/8 inch, Type X.
 - 3. Backer; 0.080 Polycarbonate.

4. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
5. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
6. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. USG Corporation; DUROCK Cement Board.
 2. Thickness: As indicated.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
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 / Reveal joints.
 - 1) Manufacturer: Gordon Interior Specialties
 - 2) Product: Series 400 Wall Trim Reveals and Series 500 Wall Reveals
 - 3) Locations :As indicated
 - g. End Cap.
 - 1) Manufacturer: Gordon Interior Specialties
 - 2) Product: Series 911 End Cap
 - 3) Location: As indicated
 - h. Mullion Mate Adjustable Partition Closure
 - 1) Manufacturer: Gordon Interior Specialties
 - 2) Product: Mullion Mate 4
 - a) Provide Series 911-EC -375
 - b) Coverage: 4 to 4-15/16"
 - c) Locations: End of wall and window framing and other locations as indicated.
 - 3) Product: Mullion Mate 5
 - a) Provide Series 911-EC -375
 - b) Coverage: 5 to 6-15/16"
 - c) Locations: End of wall and window framing and other locations as indicated.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.

2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. 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.
 5. Skim Coat: For final coat of Level 4 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Type X: As indicated on Drawings.
 2. Impact Resistant Type: As indicated on Drawings.
 3. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular 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. 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 face 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. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at ceramic tile and where indicated.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. Bullnose Bead: Use at outside corners where indicated.
 3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. U-Bead: Use where indicated.

6. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.
 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including proposed hanger wire anchors.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

- A. Test reports: Manufacturer will provide test certification for minimum requirements as tested in accordance with applicable industry standards and/or to meet performance standards specified by various agencies.
- B. Changes from system: System performance following any substitution of materials or change in assembly design must be certified by the manufacturer.
- C. All ceiling panel cartons must contain UL label for acoustical compliance.
- D. All suspension system cartons must contain UL label for load compliance per ASTM C635.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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 panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to Seismic Category C.
1. Provide manufacturer's approved and tested seismic assembly complying with:
 - a. American Society of Civil Engineers 7-05: Minimum Design Loads for Buildings and Other Structures.
 - b. CISCA: Guidelines for Seismic Restraint Direct Hung Suspended Ceiling Assemblies Seismic Zones 3 & 4.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 2. Smoke-Developed Index: 50 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; 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.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply

with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "Fine Fissured: 1714" by Armstrong World Industries or comparable product by one of the following:
1. USG Corp.
 2. CertainTeed Corp.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 2. Pattern: E (lightly textured).
- C. Fire Classification: Class A.
- D. Color: White.
- E. NRC: Not less than 0.55.
- F. CAC: Not less than 35.
- G. Edge/Joint Detail: Square.
- H. Thickness: **3/4 inch**.
- I. Modular Size: **24 by 48 inches**.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than **0.106-inch**-diameter wire.
- D. Hanger Rods: 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 A 653/A 653M, **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 seismic forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

2.5 METAL SUSPENSION SYSTEM

- 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 Corp.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than **G30** coating designation; with prefinished **15/16-inch-** wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel or aluminum cold-rolled sheet.
 5. Cap Finish: Match panel color.
 6. Basis of Design: Armstrong Prelude XL 15/16" Exposed Tee.

2.6 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 Corp.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. 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 C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 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 either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 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 and publications.
- 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 post installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
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, leveling with ceiling suspension system to a tolerance of **1/8 inch in 12 feet**. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Ceiling Perimeter (Seismic Considerations): Install edge moldings (7/8" minimum) and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Tee ends shall be tied together with manufacturer supplied Stabilizer Bars or other approved means to prevent the tees from spreading apart.
 2. Maintain a 3/8" clearance between the ends of the suspension members and the wall. The unattached ends of the suspension members shall rest upon and be free to slide perpendicularly to the perimeter molding.
 3. Alternate Perimeter Attachment: When approved by local code officials install 7/8" edge molding with grid manufacturers Seismic Clip accessory in lieu of stabilizer bars.
- F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match the products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Base and Moldings: provide 5% extra stock of the total installed quantity for each color, style, and size installed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
 2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 3. Johnsonite; A Tarkett Company.
 4. Nora Systems, Inc.
 5. Roppe Corporation, USA.
- B. **Products:** Subject to compliance with requirements, provide the basis of design product indicated by Architect or the following equivalent products matching the basis of design products, characteristics and color:
1. Approved equal
- C. Colors: As selected by Architect from full range of industry colors
- D. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
1. Group: I solid, homogeneous
 2. Style and Location:
 - a. Style B, Cove: Provide in areas with resilient flooring
 - 1) Profile: As indicated
- E. Thickness: 0.125 inch
- F. Height: 4".
- G. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- H. Outside Corners: Job formed or preformed.
- I. Inside Corners: Job formed or preformed.

2.2 RESILIENT MOLDING ACCESSORY (TS)

- A. Resilient Molding Accessory:
1. Basis-of-Design Product: Subject to compliance with requirements, available products that may be incorporated into the Work include, but not limited to the products indicated by Architect.
- B. Description:
1. Reducer strip for resilient floor covering
 2. Joiner for tile
 3. Carpet Transition strips.
- C. Material: Vinyl
- D. Colors and Patterns: To be determined by owner.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

SECTION 09 6519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
1. Show details of special patterns.
- C. Samples: Full-size units of each color and pattern of floor tile required.
1. For heat-welding bead, manufacturer's standard-size Samples, but not less than **9 inches** long, of each color required.
- D. Samples for Initial Selection: For each type of floor tile indicated.
- E. Samples for Verification: Full-size units of each color and pattern of floor tile required.
1. For heat-welding bead, manufacturer's standard-size Samples, but not less than **9 inches** long, of each color required.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Floor Tile: Furnish one box for every **50** boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than **50 deg F** or more than **90 deg F**. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **70 deg F** or more than **90 deg F**, in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than **55 deg F** or more than **90 deg F**.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.
- C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 VINYL COMPOSITION FLOOR TILE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Armstrong World Industries, Inc.
- B. Products: Standard Excelon Multicolor
- C. Color: As selected by Architect from manufacturer's full range of standard colors.
- D. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- E. Wearing Surface: Smooth.
- F. Thickness: **0.125 inch**
- G. Size: **12 by 12 inches.**

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
 - 1. Products:
 - a. Ardex Feather Finish
 - b. Mapei Planipatch
 - 2.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content:
 - a. Vinyl Composition Tile Adhesives: 50 g/L or less.
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.
- D. Moisture vapor barrier: Basis of Design: Laticrete DRYTEK Moisture Vapor Barrier.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Apply moisture vapor barrier (Basis of Design: Laticrete DRYTEK Moisture Vapor Barrier) over new concrete slabs. Install per manufacturer's written instructions, including all testing required to be done before installation of the moisture vapor barrier.
 - 2. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - a. Coordinate removal of existing flooring systems with the selective demolition and asbestos abatement specifications, if any.

3. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - a. If solvent methods are used to remove asbestos mastics comply with the procedures outlined in the asbestos abatement specifications regarding solvent removal of mastics.
4. Alkalinity and Adhesion Testing: Perform tests recommended by moisture vapor barrier manufacturer and floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by the manufacturers in writing.
5. Moisture Testing: Perform tests recommended by moisture vapor barrier manufacturer and the floor tile manufacturer. Proceed with installation only after substrates passes testing according to the manufacturers' written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft.** in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum **75** percent relative humidity level, or less if required by either moisture vapor barrier manufacturer or the floor tile manufacturer.
- C. Floor Preparation Sequence
 1. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a substrate surface meeting the requirements of the moisture vapor barrier manufacturer and the floor tile manufacturer.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply three coat(s).
- E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
- F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
 - 1. Sealer: Apply two base coats of liquid sealer.
 - 2. Finish: Apply three coats of liquid floor finish.
- G. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- B. See Division 01 sections (including, but not limited to, 01 7700, 01 7823, 01 7839, 01 8200) for additional requirements.

1.5 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. Provide in unopened cans no larger than 1 gallon in size.
1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Contractor Qualifications: Contractor and contractor's staff shall have a minimum 5 years' satisfactory experience in jobs similar in size and nature of the work of this contract. Upon request provide list of projects with references for work performed in the last 5 years.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.
 6. Surface preparation requirements.
 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than **45 deg F**.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between **50 and 95 deg F**.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than **5 deg F** above the dew point; or to damp or wet surfaces.
- C. Lead Paint: Lead paint may be present in buildings and structures to be painted. Refer to Division 2 for report.. Examine report to become aware of locations where lead paint is present.
1. Use Lead Safe Work Practices in accordance with US Dept.of Housing and Urban Development. All employees working with Lead based paint Materials shall have HUD approved training.
 2. Do not disturb lead paint or items suspected of containing hazardous materials except under procedures specified.
 3. Perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.
- D. Color Selections: Color selections for the work at the Courthouse and Annex shall match existing.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
1. Benjamin Moore & Co.
 2. Devco
 3. Glidden Professional, Division of PPG Architectural Finishes, Inc.
 4. Pratt & Lambert.
- B. Colors: As selected by Architect from manufacturer's full range.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 PATCHING MATERIALS

- A. Wood Patching Compound: 2-part polyester or epoxy-resin wood compound with a 10- to 15-minute cure at **70 deg F**, in knife grade formulation and recommended by manufacturer for type of wood repair indicated. Compound shall be produced for filling damaged wood materials that have deteriorated due to weathering and exposure. Filler shall be capable of filling deep holes and capable of spreading to featheredge.
- B. Metal Patching Compound: 2-part polyester-resin metal patching compound with a 10- to 15-minute cure at **70 deg F**, in knife grade formulation and recommended by manufacturer for type of metal repair indicated. Compound shall be produced for filling metal that has deteriorated due to corrosion. Filler shall be capable of filling deep holes and capable of spreading to featheredge.
- C. Interior Plaster Patching Compound: Provide spackle and plaster patching compounds and repair materials specifically manufactured for surface preparation and sanding prior to repainting.
 - 1. Existing Keene's Cement: Refer to Division 09 Section "Gypsum Plastering."

2.4 CLEANING MATERIALS

- A. Detergent Cleaning Solution: Mix **2 cups** of tetrasodium polyphosphate, **1/2 cup** of laundry detergent, **5 quarts** of 5 percent sodium hypochlorite bleach, and **15 quarts** of warm water for each **5 gal.** of solution required.
- B. Job-Mixed Mold, Mildew, and Algae Remover: Mix **2 cups** of tetrasodium polyphosphate, **5 quarts** of 5 percent sodium hypochlorite bleach, and **15 quarts** of hot water for every **5 gal.** of solution required.

- C. Paint Deglosser: "Paint Deglosser" Item No. 42124 by Zinsser Company, Inc., or comparable product by an approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Gypsum Board: 12 percent.
 - e. Plaster: 12 percent.
 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
 3. Plaster Substrates: Verify that plaster is fully cured.
 4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Glossy surfaces of old paint films shall be cleaned and dulled prior to re-painting
- E. Fill any open joints of metal walls and metal ceilings with a paintable caulk. Remove existing prior to application.
- F. Fill all joints between metal walls and wood casings with a paintable caulk. Remove existing prior to application.

- G. Plaster surfaces: Fill and patch any cracks in plaster surfaces. Sand surfaces to minimize the surface profile of cracked and peeling areas. Eliminate defects causing abrupt surface profile differences exceeding 1/32"
- H. Cracks, holes, bulges or gouges in wall and ceiling surfaces shall be spackled and sanded smooth. Loose, peeling, blistering, chalking and scaling paint shall be removed to the refusal point by scraping. Resulting edges of all areas so scraped shall be spackled to a feathered edge and sanded smooth when dry.
- I. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- J. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- K. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any.
1. Remove all rust with wire brushes. If areas of rust still remain, use a chemical rust remover to remove the last traces, or as much of the rust as is possible.
- L. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- M. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- N. Aluminum Substrates: Remove loose surface oxidation.
- O. Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
5. Wood surfaces scheduled to be finished with an opaque finish shall be sanded as required to produce a smooth substrate for application of the new coatings. Correct new and existing abrupt surface profile differences exceeding 1/32"
- P. Wood Floors: wood surfaces scheduled to be refinished with a transparent finish shall have existing coating stripped and sanded prior to application of new coatings
- Q. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- E. Do not paint over name plates or instruction labels. Keep sprinkler heads free of paint

3.5 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4 X-Green: S-W PrepRite Block Filler, B25W25, at **100 to 200 sq. ft. per gal.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell, (Gloss Level 3), MPI #52 X-Green/#145 X-Green: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
 - d. Topcoat: Latex, interior, semi-gloss, (Gloss Level 4), MPI #43 X-Green: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
- B. Metal Substrates (Aluminum, Steel, Galvanized Steel):
 - 1. Latex System:
 - a. Prime Coat: Primer, rust-inhibitive, water based, MPI #107: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based acrylic, semi-gloss, (Gloss Level 5), MPI #147 X-Green]: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
 - d. Topcoat: Water-based acrylic, gloss, (Gloss Level 6), MPI #148 X-Green: S-W Pro Industrial Acrylic Gloss Coating, B66-660 Series, at 2.5 to 4.0 mils dry, per coat.
- C. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
 - 1. Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #39: S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 4), MPI #43 X-Green: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
- D. Wood Substrates, Pedestrian Traffic Surfaces:
 - 1. Wood Floor System:
 - a. First Coat: Miniwax High Build Polyurethane
 - b. Topcoat: Miniwax High Build Polyurethane.
- E. Gypsum Board Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, interior, MPI #149 X-Green: S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53 X-Green/#143 X-Green: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

- d. Topcoat: Latex, interior, eggshell, (Gloss Level 3), MPI #52 X-Green/#145 X-Green: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

END OF SECTION 099123

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Sleeves.
 2. Stack-sleeve fittings.
 3. Sleeve-seal systems.
 4. Sleeve-seal fittings.
 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 STACK-SLEEVE FITTINGS

- 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. Smith, Jay R. Mfg. Co.
 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL FITTINGS

- 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. Presealed Systems.

- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."

3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1 - GENERAL**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Metal pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Thermal-hanger shield inserts.
 4. Fastener systems.
 5. Pipe stands.
 6. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Metal framing systems.
 3. Pipe stands.
 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of trapeze hangers.
 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS**2.1 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. 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. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 4. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 5. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 6. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Roof drains and rainwater leaders.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail application of field-applied jackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS**2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Super-Stik.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

- ### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.6 FIELD-APPLIED JACKETS

- ### A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- ### B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

- a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.7 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers at ADA Lavatories :
 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. Engineered Brass Company.
 - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing.
 - d. Plumberex.
 - e. Truebro; a brand of IPS Corporation.
 - f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- C. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- D. Install multiple layers of insulation with longitudinal and end seams staggered.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.

- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, locations of threaded valves, and locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Storm piping directly over Operating rooms shall be supported per Seismic requirements. Importance Factor 1.5.
 - 2. All other storm piping: Importance Factor 1.0 (no seismic support required).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of storm-drainage service.

2. Do not proceed with interruption of storm-drainage service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service classes.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 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. ANACO-Husky.
 - b. Fernco Inc.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Tyler Pipe.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 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. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Tyler Pipe.
 2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
 3. Shielded, Nonpressure Transition Couplings:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Dielectric Fittings:
- 1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 - 2. Dielectric Unions:
 - 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) Capitol Manufacturing Company.
 - 2) Hart Industries International, Inc.
 - 3) Jomar International Ltd.
 - 4) Matco-Norca, Inc.
 - 5) McDonald, A. Y. Mfg. Co.
 - 6) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 7) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 150 psig at 180 deg F.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
 - 3. Dielectric Flanges:
 - 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) Capitol Manufacturing Company.
 - 2) Matco-Norca, Inc.
 - 3) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 4) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: 150 psig.
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
 - 4. Dielectric-Flange Insulating Kits:
 - a. M 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) Advance Products & Systems, Inc.
 - 2) Calpico, Inc.
 - 3) Pipeline Seal and Insulator, Inc.
 - b. Description:
 - 1) Nonconducting materials for field assembly of companion flanges.

- 2) Pressure Rating: 150 psig.
 - 3) Gasket: Neoprene or phenolic.
 - 4) Bolt Sleeves: Phenolic or polyethylene.
 - 5) Washers: Phenolic with steel-backing washers.
5. Dielectric Nipples:
- 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) Elster Perfection.
 - 2) Grinnell Mechanical Products.
 - 3) Matco-Norca, Inc.
 - 4) Precision Plumbing Products, Inc.
 - 5) Victaulic Company.
 - b. Description:
 - 1) Electroplated steel nipple complying with ASTM F 1545.
 - 2) Pressure Rating: 300 psig at 225 deg F.
 - 3) End Connections: Male threaded or grooved.
 - 4) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- O. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
 - 2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.
 - 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
 - 4. In Underground Force-Main Piping:

- a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
- b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

- 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
- 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

3.5 VALVE INSTALLATION

- A.** General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

3.6 HANGER AND SUPPORT INSTALLATION

- A.** Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B.** Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- C.** Support horizontal piping and tubing within 12 inches of each fitting[, **valve**,] and coupling.
- D.** Support vertical piping and tubing at base and at each floor.
- E.** Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F.** Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
- 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G.** Install supports for vertical cast-iron soil piping every 15 feet.
- H.** Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A.** Drawings indicate general arrangement of piping, fittings, and specialties.
- B.** Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C.** Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
 2. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.
- D. Reports: Prepare inspection and test reports and have them signed by authorities having jurisdiction. Submit all reports to Architect.

3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.

- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 8 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Roof drains.
 2. Miscellaneous storm drainage piping specialties.
 3. Cleanouts.
 4. Through-penetration firestop assemblies.
 5. Flashing materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

- A. Cast-Iron, Large-Sump, Combination Roof and Overflow Roof Drains, RD-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. Zurn Plumbing Products Group; Specification Drainage Operation. Equal to Z164
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Smith, Jay R. Mfg. Co.
 - e. Tyler Pipe.
 - f. Watts Water Technologies, Inc.
 2. Standard: ASME A112.6.4, for general-purpose roof drains.
 3. Body Material: Cast iron.
 4. Dimension of Body: Nominal 12-inch diameter.
 5. Combination Flashing Ring and Gravel Stop: Required.
 6. Outlet: Bottom.
 7. Extension Collars: Required.
 8. Underdeck Clamp: Required.
 9. Sump Receiver Plate: Required.
 10. Dome Material: Aluminum.
 11. Water Dam on Secondary overflow: 2 inches high.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES**A. Downspout Nozzles Nozzles:**

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. Zurn Plumbing Products Group; Specification Drainage Operation. Equal to Z199
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Smith, Jay R. Mfg. Co.
 - e. Tyler Pipe.
 - f. Watts Water Technologies, Inc.
2. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
3. Size: Same as connected conductor.
4. Removable Screen: Stainless steel

2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES**A. Downspout Boots:**

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

B. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

C. Test Tees :

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. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk, brass.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

D. Wall Cleanouts WCO:

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. Josam Company.

- b. MIFAB, Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Tyler Pipe.
- e. Watts Water Technologies, Inc.
- f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure: Countersunk, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies :
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ProSet Systems Inc.
 2. Standard: ASTM E 814, for through-penetration firestop assemblies.
 3. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
 4. Size: Same as connected pipe.
 5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 7. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft..
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install expansion joints, if indicated, in roof drain outlets.
 - 3. Position roof drains for easy access and maintenance.
- B. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.
- C. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- D. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 - 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 - 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate cleanouts at base of each vertical soil and waste stack.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- G. Install test tees in vertical conductors and near floor.
- H. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- I. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- J. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

- 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 230001 - GENERAL PROVISIONS FOR MECHANICAL WORK

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.
- B. Requirements of this Section apply to work in every Section of Division 23 equally as if incorporated therein.

1.2 WORK INCLUDED

- A. Work included in Division 23 - Mechanical: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for Mechanical Work covered by all sections within this Division.

1.3 SCOPE

- A. Division of the Specification into sections is for the purpose of simplification alone. Responsibility for the work of various trades shall rest with the Contractor. Various sections of this Division are related to each other as well as the mechanical drawings. Examine all drawings and read all applicable parts of the project manual in order to ensure complete execution of all work in this Division, coordinating where required with other trades in order to avoid conflicts.
- B. These specifications and accompanying drawings are intended to cover the furnishing of all labor, materials, equipment and services necessary for the complete installation and acceptable performance of the mechanical systems. Small items of material, equipment and appurtenances not mentioned in detail or shown on the drawings, but necessary for complete and operating systems shall be provided by this contractor without additional charge to the Owner and shall be included under this contract.
- C. In general, specifications establish the quality of material, equipment and workmanship. The contract documents are intended to secure for the Owner, a first-class installation in every respect. Labor shall be performed by skilled mechanics, and the entire facility, when delivered to the Owner, shall be ready for satisfactory and efficient operation.
- D. The Contractor shall carefully examine the drawings and specifications before accepting the contract. He shall call attention to any changes or additions which, in his opinion, are necessary to make possible the fulfillment of any guarantee called for by these specifications; failing which, it shall be deemed that he has accepted full responsibility for all such guarantees.
- E. The contractor shall put his work in place as fast as is reasonably possible. He shall, at all times, keep a competent foreman in charge of the work, to make decisions necessary for the diligent advancement of the work. The Contractor shall facilitate the inspection of the work by the Owner's Representative.

- F. The Contractor shall coordinate all work in the building in order to facilitate intelligent execution of the work. He shall also remove any rubbish as expeditiously as possible.
- G. Materials or products specified herein and/or indicated on the drawings by trade's names, manufacturer's names, model number or catalog numbers establish the quality of materials or products to be furnished. Model numbers are to be confirmed by the manufacturer to provide required capacities and material to meet the specifications and design intent. In no instance shall an obsolete, incomplete or inaccurate trade name, manufacturer name, model number or catalog number indicated on the drawings, result in additional charges to the owner.
- H. Points of connection or continuation of work under this contract are so marked on drawings or herein specified. In case of any doubt as to the required exact location of such points, the Owner's Representative shall decide and direct.
- I. The plumbing contractor shall provide water services to within two (2) feet of HVAC equipment requiring same, and shall terminate service with a shutoff valve. The mechanical contractor shall make the final connection to the equipment.

1.4 REFERENCE STANDARDS, CODES AND REGULATIONS

A. Requirements of Regulatory Agencies:

- 1. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with any State or local laws, ordinances, rules and regulations, the UL and NFPA regulations. The Contractor shall make all changes required by the enforcing authorities. Where alterations to and / or deviations from the Contract Documents are required by the authorities having jurisdiction, report the requirements to the Engineer and secure acceptance before work is started. All such changes shall be made in a manner acceptable to the Engineer and shall be made without cost to the Owner.
- 2. When drawings or specifications exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Installation shall be made in compliance with all applicable regulations, and utility company rules, all of which shall be considered a part of this specification and shall take precedence in the order of listing.
- 3. It is not the intent of drawings or specifications to repeat requirements of codes except where necessary for completeness in individual sections.

B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Division, in addition to other standards which may be specified in individual sections:

- 1. AABC Associated Air Balance Council
- 2. ADC Air Diffuser Balance Council
- 3. AMCA Air Moving and Conditioning Association
- 4. AGA American Gas Association
- 5. ANSI American National Standards Institute
- 6. ARI Air Conditioning and Refrigeration Institute
- 7. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
- 8. ASME American Society of Mechanical Engineers
- 9. ASTM American Society for Testing and Materials
- 10. CISPI Cast Iron Soil Pipe Institute

11.	ETL	ETL Testing Laboratories
12.	FMS	Factory Mutual Engineering and Research Corporation
13.	NAPHCC	National Standard Plumbing Code
14.	NEMA	National Electrical Manufacturer's Association
15.	NFPA	National Fire Protection Association
16.	NBFU	National Board of Fire Underwriters
17.	NEC	National Electric Code
18.	OSHA	Occupational Safety and Health Administration
19.	PDI	Plumbing Drainage Institute
20.	SMACNA	Sheet Metal & Air Conditioning Contractors National Association
21.	UL	Underwriters Laboratories, Inc.

- C. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Contractor shall secure and obtain all approvals, permits, licenses and inspections and pay all legal and proper fees and charges in this connection, before commencing work in order to avoid delays during construction. He shall deliver the official records of the granting of the permits, etc., to the Owner's Representative.

1.5 1.5 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this section with all applicable national, state and local codes.
- D. All items of a given type shall be the product of same manufacturer.

1.6 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
1. Specifications, in general, describe quality and character of materials and equipment.
 2. Specifications are of simplified form and include incomplete sentences.
 3. Words or phrases such as "The Contractor shall", "shall be", "furnish", "provide", "a", "an", "the", and "all" may have been omitted for brevity.
- B. Drawings: Mechanical drawings under this contract are made a part of these specifications. Deviations from these specifications as noted below must have the approval of the Engineer or Construction Manager without an increase in contract price.
1. The drawings shall be considered as being diagrammatic and for bidding purposes only. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. The attention of the contractor is called to the fact that while these drawings are generally to scale and are made as accurately as the scale will permit, all critical dimensions shall be determined in the field. They are not to be considered as erection drawings.
 2. The drawings do not indicate every fitting, elbow, offset, valve, etc. which is required to complete the job. Contractor shall prepare field erection drawings as required for the use of his mechanics to insure proper installation.

3. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions.
 4. Before proceeding with work check and verify all dimensions in field.
 5. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
 6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
 7. For exact locations of building elements, refer to dimensional Architectural/Structural drawings.
- C. Description of systems: Provide all materials to provide functioning systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawings and field coordinated drawings.
1. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
- D. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.
- E. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect for his interpretation and decision as early as possible, including during bidding period.
1. Do not proceed with work without Engineer's decision.

1.7 EQUIPMENT MANUFACTURERS

- A. The first named manufacturer is used as the basis of design. Other named manufacturers are identified as equivalent manufacturers, not equivalent products. Naming other manufacturers does not necessarily imply conformance of any specific product with the written specifications.
- B. The contractor is required to verify that equipment and material to be used on the project meets the requirements of the specifications and will physically fit the available space, clearance and service requirements of the particular piece of equipment and include all pertinent information when he submits material for acceptance. Contractor shall also be responsible for and bear the cost of any modifications to openings available or anticipated as being available for rigging equipment to its final installation place. This shall include openings in exterior envelope, walls and roofs, interior walls, corridors, passage ways or door openings. Any on site dismantling and any reassembly of equipment made necessary by impediment to the rigging of said equipment shall be the sole responsibility of the contractor.
- C. Contract document indicates power and physical requirements based on the equipment manufacturer's data as first named. If equipment requiring more system capacity is furnished, the contractor shall be responsible for the cost associated with modifying the design and installation of associated services, including any redesign costs associated with the engineer's review.

1.8 DEFINITIONS

- A. "Provide": To supply, furnish, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

- B. "Install": To erect, mount and connect complete with related accessories.
- C. "Supply", "Furnish": To purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.
- E. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- F. "Wiring": Raceway, fittings, wire, boxes and related items.
- G. "Concealed": Items referred to as hidden from normal sight, embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
- H. "Exposed": Not installed underground or "concealed" as defined above.
- I. "Indicated", "Shown", or "Noted": As indicated, shown or noted on drawings or specifications.
- J. "Directed": Directed by Engineer.
- K. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product.
- L. "Reviewed", "Satisfactory", or "Directed": As reviewed, satisfactory, or directed by or to Engineer.
- M. "Motor Controllers": Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- N. "Control or Actuating Devices": Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- O. "Remove": Dismantle, demolish and take away from the site and dispose of in accordance with all applicable rules and regulations or, should the Owner so require, deliver to a location as designated by the Owner for the use of the Owner, at no additional cost to the Owner.
- P. "Replace": Remove existing and provide an equivalent product or material as specified.
- Q. "Extract (and Reinstall) ": Carefully disassemble, dismantle existing, save or store where directed by the Owner, in such a manner as to preserve the existing condition and reinstall as indicated on the drawings or as described in the specifications.
- R. Where any device or piece of equipment is referred to in the singular number, such reference shall be deemed to apply to as many devices as are required to complete the installation.

1.9 JOB CONDITIONS

- A. This contractor shall investigate all conditions affecting his work and shall provide such offsets, fittings, valves, sheet metal work, etc., as may be required to meet conditions at the building.
- B. The contractor shall verify all measurements at the building site and shall be responsible for the correctness of same before ordering materials or before starting work of any Section.
 - 1. Report to Architect, in writing, conditions which will prevent proper provision of this work.
 - 2. Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.
 - 3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.
- C. Piping and ductwork shall be concealed or run behind furring in finished spaces unless otherwise noted to be run exposed.
- D. Horizontal piping and ductwork not run below slabs on grade shall be run as close as possible to underside of roof or floor slab above and parallel to building lines. Maintain maximum headroom in all areas.
- E. Determine possible interference between trades before the work is fabricated or installed. The contractor must coordinate his work to insure that erection will proceed without such interference. Coordination is of paramount importance and no request for additional payment will be considered where such request is based upon interference between trades.
- F. Connections to Existing Work:
 - 1. Install new work and connect to existing work with minimum of interference to existing facilities.
 - 2. Temporary shutdowns of existing services:
 - a. At no additional charges
 - b. At times not to interfere with normal operation of existing facilities.
 - c. Only with written consent of Owner.
 - 3. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
 - 4. Restore existing disturbed work to original condition.
- G. Removal, extraction and relocation of existing work.
 - 1. The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the site. Rubbish and debris shall be removed from the site daily unless otherwise directed so as to not allow accumulation inside or outside the building. Materials that cannot be removed daily shall be stored in areas specified by the Owner.
 - 2. Title to all materials and equipment to be demolished, excepting Owner salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Owner will not be responsible for the condition, loss or damage to such property after notice to proceed.
 - 3. The Owner reserves the "Right of First Refusal" on all material for salvage. Material for salvage shall be stored as approved by the Owner. Salvage materials shall be removed

- from the site before completion of the Contract. Material for salvage shall not be sold on the site.
4. Property of the Owner: Salvaged items remaining the property of the Owner shall be removed in a manner to prevent damage and packed or crated to protect the items from damage while in storage or during shipment and relocated by the contractor at no cost, to the Owners designated storage facility on the site. Containers shall be properly identified as to contents.
 5. Damaged Items: Items damaged during removal or storage shall be repaired or replaced to match existing.
 6. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing conditions.
 7. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits, and/or ducts.
 8. Provide new material and equipment required for relocated equipment.
 9. Plug or cap active piping or ductwork behind or below finish.
 10. Do not leave long dead-end branches.
 - a. Cap or plug as close as possible to active line.
 11. Remove unused piping, ductwork and equipment.
 12. Dispose of unusable piping, ductwork and material.

1.10 CLEARANCE FROM ELECTRICAL EQUIPMENT

- A. Piping or ductwork:
1. Prohibited, except as noted, in:
 - a. Electric rooms and closets.
 - b. Telephone rooms and closets.
 - c. Elevator machine rooms.
 - d. Electric switchboard room.
 2. Prohibited, except as noted, over or within 5 ft. of:
 - a. Transformers.
 - b. Substations.
 - c. Switchboards.
 - d. Motor control centers.
 - e. Standby power plant.
 - f. Bus ducts.
 - g. Electrical panels.
 3. Drip pans under piping:
 - a. Only where unavoidable and approved.
 - b. 18 gauge galvanized steel.
 - 1) With bituminous paint coating.
 - c. Reinforced and supported.
 - d. Watertight.
 - e. With 1-1/4 inch drain outlet piped to floor drain or service sink.

1.11 TEMPORARY FACILITIES

- A. Temporary facilities are not included within this Section.

1.12 SPECIAL TOOLS

- A. Furnish to Owner at completion of work:
 - 1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of the Division.
 - 2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.
 - 3. One pressure grease gun for each type of grease required.
 - a. With adapters to fit all lubricating fittings on equipment.
 - b. Include lubricant for lubricated plug valves.

1.13 PRODUCT DELIVERY, HANDING AND STORAGE

- A. Provide adequate and secure storage facilities for materials and equipment during the progress of the work.
- B. Contractor shall be responsible for the condition of all materials and equipment employed in the mechanical installation until final acceptance by the Owner. Protect same from any cause whatsoever.
- C. Where necessary, ship in crated sections of size to permit passing through available space.
- D. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.
- E. Handle and ship in accordance with manufacturer's recommendations.
- F. Provide protective coverings during construction.
- G. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by Engineer.
- H. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.
- I. Include packing and shipping lists.
- J. Adhere to special requirements as specified in individual sections.

1.14 PROTECTION OF MATERIALS

- A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.
- B. Provide temporary storage facilities for materials and equipment.
- C. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
 - 1. Remove from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.

- D. Cover motors and other moving machinery to protect from dirt and water during construction. Rotate moving equipment, shafts, bearings, motors etc. to prevent corrosion and to circulate lubricants.
- E. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.
 - 1. Contractor shall be responsible for the replacement of all damaged or defective work, materials or equipment. Do not install sensitive or delicate equipment until major construction work is completed.
 - 2. Remove replaced parts from premises.
- F. Make good any damage to the work caused by floods, storms, accidents, acts of God, acts of negligence, strikes, violence or theft up to time of final acceptance by the Owner.
- G. Do not leave any mechanical work in a hazardous condition, even temporarily.

1.15 REVIEW OF CONSTRUCTION

- A. Work may be reviewed at any time by representative of the Engineer.
- B. Advise Architect and Engineer that work is ready for review at following times:
 - 1. Prior to backfilling buried work.
 - 2. Prior to concealment of work in walls and above ceilings.
 - 3. When all requirements of Contract have been completed.
- C. Neither backfill nor conceal work without Engineer's consent.
- D. Maintain on job a set of Specifications and Drawings for use by Engineer's representatives.

1.16 SCHEDULE OF WORK

- A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.
- B. In scheduling, anticipate means of installing equipment through available openings in structure.
- C. Confirm in writing to Architect and Engineer, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems.
 - 1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
 - 2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.
- D. Arrange with Owner schedule for work in each area.
- E. Unless otherwise directed by Owner, perform work during normal working hours.
- F. Work delays:

1. In case noisy work interferes with Owner's operations, Owner may require work to be stopped and performed at some other time, or after normal working hours.

1.17 ACCESS TO MECHANICAL WORK

- A. Access doors in walls and ceilings.
- B. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.
- C. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.
- D. Furnish to the general contractor all access doors necessary for access through inaccessible wall or ceiling construction, for installation by the general contractor. Information on the size and location of the subject access doors is to be communicated in writing to the general contractors during the bidding period.

1.18 CONCRETE FOR MECHANICAL WORK

- A. Concrete for Mechanical Work
 1. Basins and curbs for mechanical equipment.
 2. Mechanical equipment foundations and housekeeping pads.
 3. Inertia bases for isolation of mechanical work.
 4. Rough grouting in and around mechanical work.
 5. Patching concrete cut to accommodate mechanical work.
- B. Quality control testing for concrete is required as work of this section.
- C. Concrete Work Codes and Standards:
 1. Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards; whichever is the most stringent in its application to work in each instance.
 - ACI 301 "Specifications for Structural Concrete for Buildings"
 - ACI 311 "Recommended Practice for Concrete Inspection"
 - ACI 318 "Building Code Requirements for Reinforced Concrete"
 - ACI 347 "Recommended Practice for Concrete Form work"
 - ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"
 - Concrete Reinforcing Steel Institute's, "Manual of Standard Practice"
- D. Submittals: Shop Drawings, Mechanical Concrete Work: Submit shop drawings for structural type concrete work, showing dimensions of formed shapes of concrete; bending, placement, sizes and spacing of reinforcing steel; location of anchors, isolation units, hangers and similar devices to be integrated with concrete work; and piping penetrations, access openings, inlets and other accessories and work to be accommodated by concrete work.

- E. Laboratory Test Reports, Mechanical Concrete Work: Submit laboratory test reports for concrete work materials, and for tested samples of placed concrete (where required as work of this section).

1.19 NOISE REDUCTION

- A. Cooperate in reducing objectionable noise or vibration caused by mechanical systems.
1. To extent of adjustments to specified and installed equipment and appurtenances.
- B. Correct noise problems caused by failure to install work in accordance with Contract Documents.
1. Include labor and materials required as result of such failure.

1.20 CUTTING AND PATCHING

- A. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified.
- B. Do not cut or drill structural members without consent of Architect.

1.21 COORDINATION DRAWINGS

- A. Layout Shop Drawings Required:
1. Prepare layout shop drawings for all areas; minimum 3/8 inch scale.
 2. Individual coordinated trade layout drawings are to be prepared for all areas.
 3. General Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.
 - a. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
 4. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by General Contractor.
 5. All changes shall be clearly marked on each submitted layout drawing.
 6. Drawings shall show work of all trades including but not limited to'
 - a. Ductwork.
 - b. Piping: All Trades.
 - c. Mechanical Equipment.
 - d. Electrical Equipment.
 - e. Main Electrical conduits and bus ducts.
 - f. Equipment supports and suspension devices.
 - g. Structural and architectural constraints.
 - h. Show location of:
 - 1) 1) Valves
 - 2) 2) Piping specialties
 - 3) 3) Dampers
 - 4) 4) Access Doors
 - 5) 5) Control and electrical panels
 - 6) 6) Disconnect switches
 7. Drawings shall indicate coordination with work in other Divisions that must be incorporated in mechanical spaces, including, but not limited to:
 - a. Elevator equipment.

- b. Cable trays not furnished under Division 16.
 - c. Computer equipment.
 - 8. Submission of drawings:
 - a. Prepare reproducible drawings.
 - b. Submit to other trades for review of space allocated to all trades.
 - c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades.
 - d. Review revisions and other trades.
 - e. Submit one reproducible and one blueline print to Engineer for review.
 - 9. Final prepared drawings shall show that other trades affected have made reviews and signed, by each trade, at completions of coordination.
 - a. General Contractor
 - b. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
 - 10. No layout shop drawing will be reviewed without stamped and signed coordination assurance by General Contractor.
- B. Shop Drawings:
 - 1. Layout drawings of mechanical equipment rooms and penthouses showing all related equipment and equipment clearances required by other trades.
 - 2. Layout drawings of areas in which it may be necessary to deviate substantially from layout shown on the drawings. Minor transitions in ductwork, if required due to job conditions, need not be submitted as long as the duct area is maintained. Show major relocation of ductwork and major changes in size of ducts. Coordinate shop drawings with all trades prior to ductwork fabrication.
 - 3. Details of intermediate structural steel members required to span main structural steel for the support of ductwork.
 - 4. Method of attachment of duct hangers to building construction.
 - 5. Duct material, gage, type of joints and duct reinforcing for each size range, including sketches or SMACNA plate numbers for joints, method of fabrication and reinforcing.

1.22 GUARANTEE

- A. Furnish guarantee covering all work in accordance with general requirements of the contract for minimum period of one year. This personal guarantee shall exist for a period of one (1) year from the date of final acceptance of the work and shall apply to defects in materials and to defective workmanship of any kind.
- B. For factory-assembled equipment and devices on which the manufacturers furnish standard published guarantees as regular trade practice, obtain such guarantees and replace any such equipment that proves defective during the life of these guarantees.
- C. Guarantee all work for which materials are furnished, fabricated or field erected by the contractor, all factory-assembled equipment for which no specific manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guaranteed equipment.
- D. In the event of failure of any work, equipment or device during the life of the guarantee, repair or replace the equipment or defective work. Remove, replace or restore, at no cost to the Owner, any part of the structure or building which may be damaged either as the direct result of the

defective work or in the course of the contractor's making replacement of the defective work or materials. Work shall be done at a time and in a manner as to cause no undue inconvenience to the Owner. Provide new materials, equipment, apparatus and labor to replace that determined by Engineer to be defective or faulty.

- E. This guarantee also applies to services including Instructions, Adjusting, Testing, Noise, Balancing, etc.
- F. Additional equipment and material guarantees and warranties may be indicated in other sections. In all cases, the more stringent guarantee or warranty shall be provided.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT QUALITY

- A. Material and equipment furnished under this Division of specification shall be new. Defective or inferior materials must be replaced by contractor at no cost to Owner regardless of the stage of construction. Inferior material shall be defined as material or equipment of a quality or performance less than that specified as determined by the Owner's Representative.
- B. Provide each item of equipment with manufacturer's identification tag which is readily accessible and clearly shows model and size.

2.2 ACCESS TO MECHANICAL WORK

- A. Access Doors:
 - 1. General: Where walls and ceilings must be penetrated for access to mechanical work, access doors shall be provided. Furnish adequate size for intended and necessary access. Furnish doors with UL Fire Rating to match wall or ceiling construction. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- B. Access Door Construction: Refer to Section 083113 – ACCESS DOORS AND FRAMES

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Perform as specified in individual sections, and as required by authorities having jurisdiction.
 - 2. Duration as noted.
- B. Provide required labor, material, equipment, and connections.
- C. Furnish written report and certification those tests have been satisfactorily completed.
- D. Repair or replace defective work, as directed.

- E. Pay for restoring or replacing damaged work due to tests as directed.
- F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.2 3.2 ACCESS TO MECHANICAL WORK

- A. Coordinate installation and placement of access doors and panels with contractor for general construction.
- B. Remove or replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 230001

SECTION 230002 – MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included in This Section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
1. Motors.
 2. Factory-wired equipment (FWE).
 3. Factory-wired control panels (FWCP).
 4. Motor controllers where provided as part of mechanical equipment.
 5. Motor controllers where supplied under Division 23 - Mechanical Work.
 6. Disconnects and safety switches for mechanical equipment.
 7. Fuses for equipment provided, and starters and disconnect switches.
 8. Emergency Pushbutton Operator Station.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 23 - HVAC Instrumentation and Controls, Motors.
- B. Division 26 - Electrical: Installation and Power Wiring of Motor Controllers.

1.3 REFERENCE STANDARDS

- A. Published specifications standards, tests, or recommended methods of trade, industry or governmental organization as apply to work in this section where cited below:
1. ANSI - American National Standards Institute.
 2. NEMA - National Electrical Manufacturer's Association.
 3. IEEE - Institute of Electrical and Electronic Engineers.

1.4 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.03 of this Section and with all applicable National, State and local codes.
- D. All items of a given-type shall be the products of the same manufacturer.

1.5 DIVISION OF WORK

- A. This section delineates the work required to be performed by Contractors under Divisions 23 and 26.

1.6 WORK REQUIRED UNDER DIVISION 23

- A. Furnish motors, manual and combination starters, pushbutton devices, contactors, disconnect switches, electric thermostats, low voltage transformers, Emergency Break Glass Stations and other electrical devices required for equipment furnished.
- B. Install all items in piping and ductwork such as control valves, aquastats, ductstats, etc.

- C. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring, boiler wiring, Emergency Break Glass Stations, and mounting of control devices, etc., shall be included under Division 23. All external wiring shall be in conduit. (Unless specifically shown to be provided by the Electrical Contractor)
- D. The Electrical Contractor, under Division 26, shall furnish and install all power wiring and conduit to junction box, to disconnect switch on unit, to motor starters and contactors, and between motor starters and contactors to motor or other load. Electrical Contractor shall be responsible for proper direction of rotation for all three phase equipment. The Electrical Contractor shall mount all starters, disconnects.
- E. Wiring required under Division 23 shall comply with the specifications as described in Division 26.
- F. The Plumbing Contractor, under Division 22, shall provide water and natural gas services to within two (2) feet of HVAC equipment requiring same and terminating with shut-off valves. The HVAC Contractor, under Division 23, shall make final connections to equipment.
- G. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to furnish units)
- H. Emergency Generator - Exhaust muffler and flexible exhaust connection shall be furnished by the generator manufacturer under Division 26. Installation of the exhaust system including providing piping, insulation and accessories shall be included under Division 23.

1.7 SUBMITTALS

- A. Shop Drawings: Complete wiring diagrams of all power and control connections (standard diagrams will not be accepted). Deliver 2 copies of approved wiring diagrams to the Electric Contractor for installation of wiring and connections required under the Electric Contract.
- B. Product Data for Motor Controllers and Disconnect Switches: Manufacturer's catalog sheets, specifications and installation instructions. Submit enclosure type coordinated for service and location. Submit simultaneously with product data required for motors. Identify each controller for use with corresponding motor. Submit shop drawings and product data in accordance with project requirements.
- C. All warranties shall be delivered as part of the close-out submission.
- D. A receipt shall be delivered as part of the close-out submission that states all required spare parts have been delivered to the owner. This receipt must be signed and dated by the owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Motor Controllers and Disconnects
 - 1. Square D
 - 2. Allen-Bradley
 - 3. General Electric
 - 4. Cutler-Hammer

2.2 MOTOR CONTROLLERS

- A. General: All starters shall be correctly sized to motor connected thereto. Provide one (1) additional auxiliary contact over and above that normally furnished, at least two (2) required.

Provide overload heaters for each phase. Coordinate starters and controllers with the temperature control Contractor and sequence of operations.

- B. Minimum Size: The minimum allowable size of single or three phase magnetic motor controller is NEMA size 0.
- C. Enclosures: Unless otherwise indicated furnish NEMA 1 enclosures, except where installed outdoors furnish NEMA 3R enclosures.
- D. Control Power: Furnish control power transformer (maximum control voltage 120 volts) mounted within each magnetic motor controller enclosure.
- E. Local Control Devices: Where indicated, furnish standard duty push buttons or 3-position hand-off-auto selector switch mounted in the controller enclosure.
- F. Pilot Lights: Furnish pilot lights of the neon lamp type mounted in the controller enclosure, green for running, red for not running.
- G. Motor Controller Types:
 - 1. Type A (Full Voltage, Manual, Non-Magnetic):
 - a. Allen-Bradley Co. Bulletin 609 (or Bulletin 600 - single phase, 1 HP or less only).
 - b. General Electric Co. CR-1062 (or CR-101 - single phase, 1 HP or less only).
 - c. Square D Co. Class 2510, Type M (or Class 2510, Type F - single phase, 1 HP or less only).
 - d. Cutler-Hammer. B100 (or MS - single phase, 1 HP or less only).
 - 2. Type A2 (2 Speed, 2 Winding, Full Voltage, Manual, Non-Magnetic):
 - a. Allen-Bradley Co. Bulletin 609TS (or Bulletin 600 - single phase, 1 HP or less only).
 - b. General Electric Co. CR-1062 (or CR-101 - single phase, 1 HP or less only).
 - c. Square D Co. Class 2512, Type M (or Class 2512, Type F - single phase, 1 HP or less only).
 - 3. Type B (Full Voltage Magnetic):
 - a. Allen-Bradley Co. Bulletin 709.
 - b. General Electric Co. CR-206.
 - c. Square D Co. Class 8536.
 - d. Cutler-Hammer. ECN05.
 - 4. Type B-COM (Combination Full Voltage Magnetic/Safety Switch):
 - a. Allen-Bradley Co. Bulletin 712.
 - b. General Electric Co. CR-208.
 - c. Square D Co. Class 8538.
 - d. Cutler-Hammer. ECN16.
 - 5. Type B2 (2 Speed, 2 Winding, Full Voltage, Magnetic):
 - a. Allen-Bradley Co. Bulletin 715.
 - b. General Electric Co. CR209.
 - c. Square D Co. Class 8810.
 - d. Cutler-Hammer. ECN33.
 - 6. Type C (Automatic, Reduced Voltage, Magnetic):
 - a. Allen-Bradley Co. Bulletin 746.
 - b. General Electric Co. CR-231.
 - c. Square D Co. Class 8606.
 - d. Cutler-Hammer. ECA42.
 - 7. Type C-COM (Combination Automatic, Reduced Voltage, Magnetic/ Safety Switch):
 - a. Allen-Bradley Co. Bulletin 746C.

- b. Square D Co. Class 8606.
- c. Cutler-Hammer. ECA43.
- 8. Type D (Part Winding, Magnetic):
 - a. Allen-Bradley Co. Bulletin 736.
 - b. General Electric Co. CR-230.
 - c. Square D Co. Class 8640.
 - d. Cutler-Hammer. ECA45.

2.3 REMOTE PUSH BUTTON STATIONS

- A. Start-Stop with pilot light in NEMA 1 enclosure unless otherwise indicated.
 - 1. Allen-Bradley Co. Bulletin 800S.
 - 2. General Electric Co. CR-2943.
 - 3. Square D Co. Class 9001.
 - 4. Cutler-Hammer. Class 10250.

2.4 SAFETY SWITCHES

- A. General Electric Co. Type TH; Square D Co. Heavy Duty Series; Cutler-Hammer HD Series; with the following:
 - 1. Fused or unfused as required.
 - 2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 16181 (U.L. Class RK-1, RK-5, L).
 - 3. NEMA 1 enclosure unless otherwise indicated on drawing or required. 3R for devices installed outdoors.
 - 4. Switch rated 240V for 120V, 208V, 240V, circuits; 600 V for 277V, 480V circuits.
 - 5. Switch rated 600V for 277V, 480V circuits.
 - 6. Solid neutral bus when neutral or grounding conductor is included with circuit.
 - 7. Current rating and number of poles as indicated on drawings.

2.5 NAMEPLATES

- A. Phenolic Type: Standard phenolic nameplates with 3/8" minimum size lettering engraved thereon.
- B. Embossed Aluminum: Standard stamped or embossed aluminum tags: Tech Products, Inc., Seton Name Plate Corp.

2.6 EMERGENCY PUSHBUTTON OPERATOR STATION

- A. Acceptable Manufacturer: Square D or equal.
- B. Switch Style: Class 9001, NEMA 4 rated emergency mushroom head pushbutton.
- C. Voltage: 120VAC, 60Hz as required.
- D. Contacts: 20A, 2-NO/2-NC contact.
- E. Operation: Manual.
- F. Normal position: Operator out.
- G. Activated position: Operator in.
- H. Reset: Manual, turn to release.
- I. Enclosure: NEMA 4.

- J. Custom Legend Plate
 - 1. "EMERGENCY BOILER SHUTOFF"

PART 3 - EXECUTION

3.1 GENERAL

- A. Equipment shall be connected in a neat and skillful manner. Equipment delivered with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions by the Mechanical Contractor furnishing the equipment.
- B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not over 18" long.
- C. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.
- D. All electrical work required in the Mechanical Contract shall conform to the applicable requirements of Division 26 of these Specifications.
- E. The Heating, Ventilating, and Air Conditioning Contractor shall assign all Electrical Work required under his contract to the approved Automatic Temperature Control Contractor, who shall perform this work with qualified electricians employed by that Contractor.
- F. The Mechanical Contractors shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing, and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these contracts.
- G. Install heaters correlated with full load current of motors provided.
- H. Set overload devices to suit motors provided.

3.2 INSTALLATION

- A. Control Wiring:
 - 1. Provide control wiring and connections.
 - 2. Where control circuit interlocking is required between individually mounted motor controllers, provide a single pole on-off switch in a threaded type box mounted adjacent to motor safety switches which are remote from the control transformer (to enable interlock circuit to be opened when the motor safety switch is opened).
- B. Nameplates: Rivet or bolt the nameplate on the cover of NEMA 1 enclosures. Rivet or bolt and gasket the nameplate on cover of NEMA 3R or NEMA 12 enclosures. Provide phenolic or embossed aluminum nameplates as follows:
 - 1. On each remote control station, indicating motor controlled.
 - 2. On each interlock circuit switch, indicating purpose of switch.
- C. Emergency Pushbutton Operator Station: Wire all switches in series with boiler control branch circuits.

3.3 TYPES OF MOTOR CONTROLLERS REQUIRED FOR SINGLE SPEED MOTORS (SYSTEMS UNDER 250 VOLTS)

- A. Single Phase Motors Less than 5 HP - Manually Operated: Type A.
- B. Single Phase Motors Less than 1/2 HP - Automatically Operated: Type A.

- C. Single Phase Motors 1/2 to 5 HP - Automatically Operated: Type B.
- D. Three Phase Squirrel Cage Motors Less than 7-1/2 HP: Type B (B-COM when indicated on drawings).
- E. Three Phase Squirrel Cage Motors 7-1/2 HP and Larger: Type C (C-COM when indicated on drawings).
- F. Three Phase Hermetically Sealed Compressor Motors Less than 7-1/2 HP: Type B.
- G. Three Phase Hermetically Sealed Compressor Motors 7-1/2 HP and Larger: Type D.

3.4 TYPES OF MOTOR CONTROLLERS REQUIRED FOR SINGLE SPEED MOTORS (277/480 VOLT SYSTEM)

- A. Single Phase Motors Less than 5 HP - Manually Operated: Type A.
- B. Single Phase Motors Less than 1 HP - Automatically Operated: Type A.
- C. Single Phase Motors 1 to 5 HP - Automatically Operated: Type B.
- D. Three Phase Squirrel Cage Motors Less than 15 HP: Type B (B-COM when indicated on drawings).
- E. Three Phase Squirrel Cage Motors 15 HP and Larger: Type C (C-COM when indicated on drawings).
- F. Three Phase Hermetically Sealed Compressor Motors Less than 15 HP: Type B.
- G. Three Phase Hermetically Sealed Compressor Motors 15 HP and Larger: Type D.

3.5 DISCONNECTS

- A. Motor Controllers: Provide safety switch for all motor controllers. Provide combination type starter-disconnect unless otherwise noted on drawings.
- B. Motors: Provide a disconnect switch for all motors. Provide a separate safety switch for motors which are not within sight of the starter.
- C. Provide safety switches for all factory packaged equipment.
- D. Provide NEMA 3R safety switch for all rooftop and outdoor equipment.
- E. Provide unit mounted disconnect switches for all equipment such as unit heaters, fans, unit ventilators, incremental units, etc

3.6 EMERGENCY PUSHBUTTON OPERATOR STATION

- A. Provide Emergency Pushbutton Operator Station at each boiler room exit to de-energize the primary control circuit and to close the main fuel valves to stop the flow of fuel to the burner during an emergency.
- B. Review plans for locations.
- C. Provide all conduit and wiring for interlock of each boiler.

END OF SECTION 230002

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
1. Motor controllers.
 2. Torque, speed, and horsepower requirements of the load.
 3. Ratings and characteristics of supply circuit and required control sequence.
 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.

- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Sleeves.
 2. Stack-sleeve fittings.
 3. Sleeve-seal systems.
 4. Sleeve-seal fittings.
 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- 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. Smith, Jay R. Mfg. Co.
 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
 2. CALPICO, Inc.
 3. Metraflex Company (The).
 4. Pipeline Seal and Insulator, Inc.
 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Carbon steel.
 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- 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. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 2. Concrete Slabs above Grade:

- a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
- 3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for exposed piping penetrations of walls, ceilings, finished floors, and millwork, except in mechanical equipment rooms or unoccupied areas.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Bronze ball valves.
 2. Iron ball valves.
 3. Iron, single-flange butterfly valves.
 4. Iron, grooved-end butterfly valves.
 5. Bronze swing check valves.
 6. Bronze, grooved-end butterfly valves.
 7. Iron swing check valves.
 8. Iron, grooved-end swing-check valves.
 9. Iron, grooved-end spring-loaded check valves.
 10. Bronze gate valves.
 11. Iron gate valves.
 12. Bronze globe valves.
- B. Related Sections:
1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.

3. ASME B31.9 for building services piping valves.
- C. To assure uniformity and compatibility, all grooved end valves and adjoining couplings shall be supplied by a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set angle, gate, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 2. Handwheel: For valves other than quarter-turn types.
 3. Handlever: For quarter-turn valves NPS 6 and smaller.
 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. Gate Valves: With rising stem.
 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to AWWA C606.
 3. Solder Joint: With sockets according to ASME B16.18.
 4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Non-metallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Non-metallic.

2.4 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Powell Valves.
 - g. Red-White Valve Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions, grooved mechanical-joint couplings, or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 1. Swing Check Valves: In horizontal position with hinge pin level.

- F. Grooved end valves shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved end valves and adjoining couplings shall be the products of a single manufacturer. Grooved end shall be clean and free from indentations and projections in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly or gate valves.
 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 3. Throttling Service except Steam: ball valves.
 4. Pump-Discharge Check Valves: Refer to division "Hydronic Pumps."
- B. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 2. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.
 3. For Steel Piping, NPS 5 and Larger: Flanged ends.
 4. For Grooved-End Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

3.5 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 2. Bronze Swing Check Valves: Class 150, nonmetallic disc.
 3. Bronze Gate Valves: Class 150, bronze disc.

3.6 STEAM-CONDENSATE VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 2. Bronze Swing Check Valves: Class 150, nonmetallic disc.
 3. Bronze Gate Valves: Class 150, bronze.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Metal pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Fiberglass pipe hangers.
 4. Metal framing systems.
 5. Fiberglass strut systems.
 6. Thermal-hanger shield inserts.
 7. Fastener systems.
 8. Pipe stands.
 9. Equipment supports.
- B. Related Sections:
1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Metal framing systems.
 3. Pipe stands.

4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 3. Standard: MFMA-4.
 4. Channels: Continuous slotted steel channel with intumed lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 7. Metallic Coating: Galvanized.
 8. Paint Coating: Epoxy.
- B. Non-MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. Haydon Corporation; H-Strut Division.
 - e. NIBCO INC.
 - f. PHD Manufacturing, Inc.
 - g. PHS Industries, Inc.
 2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 3. Standard: Comply with MFMA-4.
 4. Channels: Continuous slotted steel channel with inturned lips.
 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 7. Coating: Paint.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping:
1. ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
 2. ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping:
1. Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
 2. ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
 3. ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger

and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 9. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 10. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 12. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 15. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 17. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Duct labels.
 5. Stencils.
 6. Valve tags.
 7. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch 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 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. General Requirements for Manufactured Duct Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Duct Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard or metal.
 - 2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green : For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. All services: 1-1/2 inches round.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Dual-duct systems.
 - c. Variable-air-volume systems.
 - d. Multizone systems.
 - e. Induction-unit systems.
 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Certified TAB reports.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:
1. Instrument type and make.
 2. Serial number.
 3. Application.
 4. Dates of use.
 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.

2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Complete system-readiness checks and prepare reports. Verify the following:
1. Permanent electrical-power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.
 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 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 outdoor-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 functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical 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 fans in the inlet duct as near the fan as possible, upstream from the 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.
 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.
 - 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. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure 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 air 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 air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch 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.

3.6 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.
- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.

- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.7 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.9 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.
- B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.

4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 4. Balance each air outlet.

3.11 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.12 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.

2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.

3.14 INSPECTIONS

- A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.

- e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
 - 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
 - 2. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 - 3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - 4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
 - 1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Expanded Polystyrene Insulation: Closed-cell, light-weight, resilient, foamed plastic composed of hydrogen and carbon.
 - 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Knauf Polystyrene.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.

- c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - b. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.

5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - c. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.

- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - 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) GEMCO.
 - 2) Midwest Fasteners, Inc.

2.11 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.

- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

- install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078413 "Penetration Firestopping" firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be

limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
1. Indoor, concealed supply and outdoor air.
 2. Indoor, concealed return located in unconditioned space.
 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 2. Factory-insulated flexible ducts.
 3. Factory-insulated plenums and casings.
 4. Flexible connectors.
 5. Vibration-control devices.
 6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- E. Concealed, rectangular, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- F. Concealed, rectangular, return-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- G. Concealed, rectangular, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- I. Concealed, return-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- J. Concealed, supply-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- K. Concealed, outdoor-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- L. Concealed, exhaust-air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.
 - 2. Steam and steam condensate piping, indoors and outdoors.
 - 3. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."
 - 2. Section 230716 "HVAC Equipment Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Industrial Insulation Group (IIG); Thermo-12 Gold.
 - 2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied **ASJ**: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

- H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- I. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Knauf Insulation; Permawick Pipe Insulation.
 - b. Owens Corning; VaporWick Pipe Insulation.
- K. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Trymer 2000 XP.
 - b. Duna USA Inc.; Corafoam.
 - c. Dyplast Products; ISO-25.
 - d. Elliott Company of Indianapolis; Elfoam.
 2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.
 3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thickness up to 1 inch as tested by ASTM E 84.
 4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
 5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Thermokote V.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-97.
 - b. Eagle Bridges - Marathon Industries; 290.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-27.
 - d. Mon-Eco Industries, Inc.; 22-30.
 - e. Vimasco Corporation; 760.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- G. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60.
- H. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- I. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: 60 percent by volume and 66 percent by weight.
 - 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
- 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 4. Service Temperature Range: 0 to plus 180 deg F.
 - 5. Color: White.

2.6 SEALANTS

- A. Joint Sealants:
- 1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - 2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 3. Materials shall be compatible with insulation materials, jackets, and substrates.
 4. Permanently flexible, elastomeric sealant.
 5. Service Temperature Range: Minus 100 to plus 300 deg F.
 6. Color: White or gray.
 7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 8. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: White.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

- D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Pittwrap.
 - b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.

2.11 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.

2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
 3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 4. Finish flange insulation same as pipe insulation.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
 3. Finish fittings insulation same as pipe insulation.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 2. Install insulation to flanges as specified for flange insulation application.
 3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYISOCYANURATE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
 2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.
- C. Insulation Installation on Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of polyisocyanurate insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - c. Vapor Barrier: Required
- B. Steam and Steam Condensate, 250 Deg F and Below:
1. NPS 3-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I or II: 2-1/2 inches thick.
 2. NPS 4 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches thick.
- C. Refrigerant Suction and Hot-Gas Piping:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1-1/2 inch thick.
 - b. Vapor Barrier: Required.
- D. Refrigerant Suction and Hot-Gas Flexible Tubing:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1-1/2 inch thick.
 - b. Vapor Barrier: Required.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Flanges, Fittings, Valves, and Specialties Concealed:
1. PVC: 20 mils thick.
- C. Piping, Flanges, Fittings, Valves, and Specialties Exposed:
1. PVC: 20 mils thick.
- D. Generator Exhaust Piping:
1. Aluminum, Embossed: 0.016 inches thick.

3.17 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Concealed:
1. Aluminum, Corrugated: 0.032 inch thick.
- C. Piping, Exposed:
1. Aluminum, Corrugated: 0.032 inch thick.

END OF SECTION 230719

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARYs

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
 - 1. Section 230519 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
 - 2. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- D. MS/TP: Master slave/token passing.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
 - 6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
 - 7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
 - 8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 2 percent of full scale.

- c. Water Pressure: Plus or minus 2 percent of full scale.
- d. Space Temperature: Plus or minus 1 deg F.
- e. Ducted Air Temperature: Plus or minus 1 deg F.
- f. Outside Air Temperature: Plus or minus 2 deg F.
- g. Dew Point Temperature: Plus or minus 3 deg F.
- h. Temperature Differential: Plus or minus 0.25 deg F.
- i. Relative Humidity: Plus or minus 2 percent.
- j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
- k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
- l. Airflow (Terminal): Plus or minus 10 percent of full scale.
- m. Air Pressure (Space): Plus or minus 0.01-inch wg.
- n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
- o. Carbon Monoxide: Plus or minus 5 percent of reading.
- p. Carbon Dioxide: Plus or minus 50 ppm.
- q. Electrical: Plus or minus 1 percent of reading.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 - 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 - 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
 - 4. Details of control panel faces, including controls, instruments, and labeling.
 - 5. Written description of sequence of operation.
 - 6. Schedule of dampers including size, leakage, and flow characteristics.
 - 7. Schedule of valves including flow characteristics.
 - 8. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 - 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
 - 10. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.

- b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
- c. Written description of sequence of operation including schematic diagram.
- d. Points list.

1.6 PROJECT RECORD DOCUMENTS

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 - 4. Calibration records and list of set points.
- B. Software and Firmware Operational Documentation: Include the following:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.9 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment and installation with Sections 26, 27, and 28, as appropriate, for systems integration requirements.
- C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- D. Coordinate equipment with Section 262416 "Panelboards" to achieve compatibility with starter coils and annunciation devices.

- E. Coordinate equipment with Section 262419 "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.
- F. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- G. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring, boiler wiring, Emergency Break Glass Stations, and mounting of control devices, etc., shall be included under Division 23. All external wiring shall be in conduit. Provide 120V power to all necessary control panels, controllers, etc. from nearest spare panelboard circuit breaker location. Furnish and install necessary circuit breakers. If facility contains emergency power, connect circuit(s) to emergency panelboards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Automated Control Logic Inc.

2.2 CONTROL SYSTEM

- A. Manufacturers:
 - 1. Existing Andover.
- B. All controls shall be compatible to the existing Andover controls system.

2.3 ALARM PANELS

- A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.
- B. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
 - 1. Alarm Condition: Indicating light flashes and horn sounds.
 - 2. Acknowledge Switch: Horn is silent and indicating light is steady.
 - 3. Second Alarm: Horn sounds and indicating light is steady.
 - 4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
 - 5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.4 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
- E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
 - 1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
 - 2. Proportional band shall extend from 2 to 20 percent for 5 psig.
 - 3. Authority shall be 20 to 200 percent.
 - 4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
 - 5. Gages: 2-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.5 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
 - 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.
 - f. RDF Corporation.
 - 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 - 5. Averaging Elements in Ducts: 60 inches in length per 10 sq. ft. of duct cross-sectional area; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
 - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
 - 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed in public spaces and exposed in staff spaces.
 - b. Set-Point Indication: Concealed in public spaces and exposed in staff areas.
 - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- C. RTDs and Transmitters:
 - 1. Manufacturers:

- a. BEC Controls Corporation.
 - b. MAMAC Systems, Inc.
 - c. RDF Corporation.
 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 5. Averaging Elements in Ducts: 60 inches in length per 10 sq. ft. of duct cross-sectional area; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.; length as required.
 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed in public spaces and exposed in staff spaces.
 - b. Set-Point Indication: Concealed in public spaces and exposed in staff areas.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- D. Humidity Sensors: Bulk polymer sensor element.
 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 2. Accuracy: 2 percent full range with linear output.
 3. Room Sensor Range: 20 to 80 percent relative humidity.
 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed in public spaces and exposed in staff spaces.
 - b. Set-Point Indication: Concealed in public spaces and exposed in staff areas.
 5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
 6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 20 to plus 170 deg F.
 7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
 - d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
 4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
 5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
 6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
- F. Room Pressure Monitor
1. Manufacturer:
 - a. TSI Incorporated, Model 8630
 2. General:
 - a. Must interface with the building management system.
 - b. PRESSURA™ controller has a red light and green light to provide continuous information on room pressure status.
 - c. PRESSURA™ controller has a hidden operator panel providing detailed room status information, self-testing capabilities, and access to the software programming functions.
 - d. The unit provides continuous room pressure status through the red and green light. The operator panel is normally closed unless further information on room pressure status is needed, or software programming is required.
 3. Digital Display:
 - a. The alphanumeric digital display is a two line display that indicates actual room pressure (positive, negative or no isolation), alarm status, menu options, and error messages. In normal operation (green light is on), the display continuously scrolls information about room pressure, and other variables programmed; flow, air changes per hour, etc. The variables that scroll depend on the model of PRESSURA™ controller purchased and options installed.
 4. Room pressure module:
 - a. Display
 - 1) Range: -0.20000 to +0.20000 inches H₂O
 - 2) Resolution: 5% of reading
 - 3) Display Update: 0.5 sec
 - b. Inputs
 - 1) Switch in: SPST (N.O.) Switch. Closing switch initiates condition.
 - 2) Flow in: SPST (N.O.) Switch. Closing switch initiates condition.
 - c. Outputs
 - 1) Low Alarm Range: -0.19500 to +0.19500 inches H₂O
 - 2) High Alarm Range: -0.19500 to +0.19500 inches H₂O
 - 3) Alarm Contacts: SPST (N.O.) Max current 5A, max voltage
 - 4) 150 VDC, 250 VAC. Minimum switch load 10 mA, 5 VDC. Contacts close in alarm condition.
 - d. Analog Output
 - 1) Type: 0 to 10 VDC or 4 to 20 mA
 - 2) Range: High -0.100 to +0.100 inches H₂O; Low -0.0100 to +0.0100 inches H₂O
 - 3) Resolution: 1.0% of range for 0-10 VDC; 1.2% of range for 4-20 mA
 - 4) RS-485
 - 5) Operating Temperature: 32 to 120°F

- 6) Input Power: 24 VAC, 5 watts max
- 7) Dimensions: 4.9 in. x 4.9 in. x 1.35 in
- 8) Weight: 0.7 lbs
- 5. Pressure Sensor
 - a. Temperature Compensation Range: 55 to 95°F
 - b. Power Dissipation: 0.16 watts at 0 inches H₂O, 0.20 watts at 0.00088 inches H₂O
 - c. Dimensions (DxH): 5.58 in. x 3.34 in. x 1.94 in.
 - d. Weight: 0.2 lb.
- G. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed in public spaces and exposed in staff spaces.
 - b. Set-Point Indication: Concealed in public spaces and exposed in staff areas.
- H. Room sensor accessories include the following:
 - 1. Insulating Bases: For sensors located on exterior walls.
 - 2. Adjusting Key: As required for calibration and cover screws.

2.6 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
 - 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. I.T.M. Instruments Inc.

2.7 THERMOSTATS

- A. Manufacturers:
 - 1. Erie Controls.
 - 2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
 - 3. Heat-Timer Corporation.

4. Sauter Controls Corporation.
 5. tekmar Control Systems, Inc.
 6. Theben AG - Lumilite Control Technology, Inc.
- B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
1. Label switches "FAN ON-OFF", "FAN HIGH-LOW-OFF", "FAN HIGH-MED-LOW-OFF", or as required based on the requirements.
 2. Mount on single electric switch box.
- C. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
1. Automatic switching from heating to cooling.
 2. Preferential rate control to minimize overshoot and deviation from set point.
 3. Set up for four separate temperatures per day.
 4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
 5. Short-cycle protection.
 6. Programming based on every day of week.
 7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
 8. Battery replacement without program loss.
 9. Thermostat display features include the following:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed override.
 - f. Day of week.
 - g. System mode indications include "heating," "off," "fan auto," and "fan on."
- D. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
- E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
 2. Selector Switch: Integral, manual on-off-auto.
- F. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
1. Bulbs in water lines with separate wells of same material as bulb.
 2. Bulbs in air ducts with flanges and shields.
 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

- G. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
1. Reset: Manual.
 2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
- H. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
- I. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- J. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- K. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- L. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.8 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
 7. Manual Positioning: Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 in.-lb. torque capacity shall have a manual crank.

- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 3. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 4. Coupling: V-bolt and V-shaped, toothed cradle.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 7. Manual Positioning: Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 in.-lb. torque capacity shall have a manual crank.
 8. Power Requirements (Two-Position Spring Return): 24-V ac.
 9. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 10. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 11. Temperature Rating: 40 to 104 deg F, unless used for outdoor applications.
 12. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
 13. Run Time: 12 seconds open, 5 seconds closed.

2.9 CONTROL VALVES

- A. Manufacturers:
1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
 2. Erie Controls.
 3. Hayward Industrial Products, Inc.
 4. Magnatrol Valve Corporation.
 5. Neles-Jamesbury.
 6. Parker Hannifin Corporation; Skinner Valve Division.
 7. Pneuline Controls.
 8. Sauter Controls Corporation.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Steam system globe valves shall have the following characteristics:
1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
 2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

3. Internal Construction: Replaceable plugs and stainless-steel seats.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
 4. Sizing: For pressure drop based on the following services:
 - a. Two Position: 20 percent of inlet pressure.
 - b. Modulating, 15-psig: 80 percent of inlet steam pressure.
 - c. Modulating, 16- to 50-psig Steam: 50 percent of inlet steam pressure.
 - d. Modulating, More Than 50-psig Steam: As indicated.
 5. Flow Characteristics: Modified linear characteristics.
 6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of operating (inlet) pressure.
- D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: Lug or Grooved.
 2. Disc Type: Aluminum bronze.
 3. Sizing: 1-psig maximum pressure drop at design flow rate.
- E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
 2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
- F. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
 2. Thermostatic Operator: Liquid-filled remote sensor with integral adjustable dial.

2.10 DAMPERS

- A. Manufacturers:
1. Air Balance Inc.
 2. Don Park Inc.; Autodamp Div.
 3. TAMCO (T. A. Morrison & Co. Inc.).
 4. United Enertech Corp.
 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, parallel and opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches. Blades shall be airfoil type suitable for wide-open face velocity of 2000 fpm.
1. Provide parallel blade design for two-position applications.
 2. Provide opposed-blade design for modulating applications.
 3. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated

- steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
4. Operating Temperature Range: From minus 40 to plus 200 deg F.
 5. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
 6. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.
 7. Sections: Damper sections shall not exceed 48 in. x 60 in. Each section shall have at least one damper actuator.
 8. Linkages: Dampers shall have exposed linkages.

2.11 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Section 271500 "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install wall-mounted devices 60 inches above the floor.
 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
 1. Entrances.
 2. Public areas.
 3. Where indicated.
- E. Install automatic dampers according to Section 233300 "Air Duct Accessories."
- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Section 230553 "Identification for HVAC Piping and Equipment."
- H. Install hydronic instrument wells, valves, and other accessories according to Section 232116 Hydronic Piping Specialties."
- I. Install steam and condensate instrument wells, valves, and other accessories according to Section 232216 Steam and Condensate Piping Specialties."
- J. Install refrigerant instrument wells, valves, and other accessories according to Section 232300 "Refrigerant Piping."
- K. Install duct volume-control dampers according to Section 233113 "Metal Ducts".

- L. Install electronic and fiber-optic cables according to Section 271500 "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Section 260533 "Raceways and Boxes for Electrical Systems."
- B. Install building wire and cable according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Section 271500 "Communications Horizontal Cabling."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 4. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 5. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 6. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 7. Test each system for compliance with sequence of operation.
 - 8. Test software and hardware interlocks.
- C. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.

2. Check instruments for proper location and accessibility.
 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 4. Check instrument tubing for proper fittings, slope, material, and support.
 5. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 6. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 7. Check temperature instruments and material and length of sensing elements.
 8. Check control valves. Verify that they are in correct direction.
 9. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 10. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

- A. Calibrating and Adjusting:
1. Calibrate instruments.
 2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
 3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
 5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
 6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
 7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
 9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
 10. Provide diagnostic and test instruments for calibration and adjustment of system.
 11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 TRAINING

- A. Provide training for a designated staff of Owner's representatives. Training shall be provided via classroom and on-site training. Training shall be tailored to Owner's requirements.
- B. Provide Owner training for the equivalent of 40 hours each for 3 persons.
- C. Training shall enable students to accomplish the following objectives.
1. Adjust and change system setpoints, time schedules, and holiday schedules
 2. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
 3. Understand system drawings and Operation and Maintenance manual
 4. Understand job layout and location of control components
 5. Access data from DDC controllers
 6. Operate portable operator's terminals
 7. Create and change system graphics
 8. Create, delete, and modify alarms, including configuring alarm reactions
 9. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
 10. Configure and run reports
 11. Add, remove, and modify system's physical points
 12. Create, modify, and delete application programming
- D. Instructors shall be factory-trained and experienced in presenting this material.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems and equipment.

1.2 DEFINITIONS

- A. DDC: Direct digital control.
- B. DW: Desiccant wheel.
- C. ERW: Total energy recovery wheel.
- D. VAV: Variable air volume.
- E. BAS: Building automation system; EMS: Energy management system.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 HVAC CONTROL SEQUENCES

A. General

1. All set points, changeover points and reset schedules shall be user adjustable.
2. Control algorithms shall utilize tuned PID loops to maintain set points and minimum/maximum leaving air temperatures optimally.
3. Coordinate individual alarm notifications with Owner.
4. Alarms shall be configured as status only or critical. Status only alarms shall display alarm on the Owner coordinated workstation(s) and device(s). Critical alarms shall incorporate coordinated unit shutdown along with displaying alarms on the Owner coordinated devices and require the alarm to be cleared prior to restarting the equipment.
5. All HVAC equipment shall operate in occupied/unoccupied modes as determined by the DDC building time clock system. Obtain the building occupancy schedule from the Owner.
6. All equipment shall utilize optimum start/stop programs.
7. Assign all equipment a stagger start number to keep to many units from starting at the same time. In effect, this flattens load peaks. This includes start-up on emergency power.
8. Unoccupied override buttons shall place the space equipment in occupied mode for a period of one-hour (adjustable).

- B. Universal Set Points. Unless otherwise noted, use the following space temperature set points. Set points shall be independently adjustable by space through the BMS.

	Occupied Modes		Unoccupied Modes	
	Cooling	Heating	Cooling	Heating
Occupied Spaces	74°F	69°F	85°F	55°F
Unoccupied Spaces	80°F	60°F	85°F	55°F

C. Steam Fan Coil Unit

1. Assign each fan coil unit a stagger start number to keep too many units from starting at the same time. In effect, this flattens load peaks.
2. Warm-Up Mode Control:
 - a. Optimum start duration shall be determined based on outside air temperature.
 - b. During the optimum start period, the heating set-point will be linearly ramped up from unoccupied heating set-point to occupied heating set-point.
 - c. When the heating set-point crosses above the space temperature, the supply fan will be commanded on, the mixing dampers shall remain in the full return air position and the heating valve will modulate to maintain heating set-point.
3. Cool-Down Mode Control:
 - a. Optimum start duration shall be determined based on outside air temperature.
 - b. During the optimum start period, the cooling set-point will be linearly ramped down from unoccupied cooling set-point to occupied cooling set-point.
 - c. When the cooling set-point crosses below the space temperature, the supply fan will be commanded on, the mixing dampers shall modulate to the full return air position and the chilled water control valve shall modulate to maintain the space cooling set-point.
4. Occupied Mode:
 - a. Supply Fan:
 - 1) Enable continuously.
 - b. Mixed Air Damper:
 - 1) Open to maintain outside air quantity as scheduled, outside air damper shall never be positioned below this minimum except in case of emergency.
 - c. Occupied Heating Mode (OAT is above 55°F and space temperature below set point)
 - 1) Modulate steam coil control valve to maintain space temperature set point and minimum discharge air set point.
 - a) Minimum leaving air temperature reset schedule:
65 degree LAT at 0 degree OAT.
55 degree LAT at 55 degree OAT.
 - 2) Compressors shall turn off.
 - d. Occupied Cooling Mode (OAT is above 60°F and space temperature is above set point)
 - 1) Modulate the steam coil control valve to the full closed position.
 - 2) Compressor shall modulate to maintain the space temperature setpoint..
5. Unoccupied Mode:
 - a. Supply Fan:
 - i. Start (2°F below heating set point) and stop (1°F above heating set point) to maintain space temperature set point.
 - b. Mixed Air Damper:
 - ii. Fully return air position.
 - c. Unoccupied Cooling mode
 - Compressor shall modulate to full closed position unless night cooling is required. When night cooling is required, modulate compressor to maintain space temperature set point.
 - d. Steam Control Valve:
 - Same as occupied mode.
6. Alarms – Provide an alarm for each of the following:
 - a. Fan fails to run after 30 seconds of being commanded on.
 - b. Fan fails to stop after 30 seconds of being commanded off.

- c. Software safety trip.
 - d. Software safety lockout (4 safety trips in 3 hours).
 - e. Low or high discharge air temperatures.
 - f. Low or high space temps.
- D. Unit Ventilator
- 1. Unit ventilator shall operate in occupied/unoccupied modes as determined by the DDC building time clock system.
 - 2. Occupied heating set-point, unoccupied heating set-point, unoccupied cooling set-point and purge enable/disable shall be global and fully adjustable from any interface.
 - 3. Outside air is admitted to meet ventilation and cooling requirements as outlined in the individual unit sequences.
 - 4. Each unit ventilator shall have a software HOA for control of the supply fan.
 - 5. Wire the supply fan normally open at the control relay and fail off.
 - 6. Control cycle to follow ASHRAE Cycle II Standard.
 - 7. Temperature Set Points:
 - a. Occupied heating = 69 degrees (adjustable)
 - b. Occupied ventilation cooling = 75 degrees (adjustable)
 - c. Unoccupied heating = 55 degrees (adjustable)
 - 8. Warm-Up Mode Control:
 - a. Optimum start duration shall be determined based on outside air temperature.
 - b. During the optimum start period, the heating set-point will be linearly ramped up from unoccupied heating set-point to occupied heating set-point.
 - c. When the heating set-point crosses above the space temperature, the supply fan will be commanded on, the mixing dampers shall remain closed and the heating valve will modulate to maintain heating set-point.
 - 9. Occupied Mode:
 - a. Unit Ventilator:
 - 1) Supply Fan:
 - a) Enable continuously.
 - 2) Relief Fan (see owners building schedules):
 - a) Enable continuously.
 - 3) Outside Air Damper:
 - a) Open to maintain outside air quantity as scheduled, outside air damper shall never be positioned below this minimum except in case of emergency.
 - b) Modulate outside air damper beyond scheduled minimum position as follows:
 - o Maintain ventilation cooling temperature set point.
 - 4) Steam Coil Control Valve:
 - a) LAT schedule
 - i. Utilize discharge air minimum temperature reset schedule as outlined below.
 - o 55°F LAT at 55°F OAT
 - o 65°F LAT at 0°F OAT.
 - ii. Utilize discharge air temperature PID loop to maintain space temperature set point and minimum LAT.
 - b) Outside air temperature drops below 35 degrees:
 - o Modulate full open. (Valve shall stay full open until O.A. rises above 38 degrees).
 - c) Outside air temperature above 38 degrees:
 - o Modulate to maintain space temperature set point.

- Modulate to maintain 65 degree minimum discharge air temperature during heating mode. Note: 55
 - Modulate to maintain 55 degree minimum discharge air temperature during ventilation cooling mode.
 - 5) RA Damper:
 - a) Modulate with outside air damper to maintain the following balance:
$$RA\ CFM = SA\ CFM - OA\ CFM.$$
 - 10. Unoccupied Mode By DDC Schedule:
 - a. Unit Ventilators
 - 1) Supply Fan:
 - a) Start (2°F below heating set point) and stop (1°F above heating set point) to maintain space temperature set point.
 - 2) Relief Fan:
 - a) Disable.
 - 3) Outside Air Damper:
 - a) Fully closed.
 - 4) Steam Coil Control Valve:
 - a) Same as occupied mode.
 - 5) RA Damper:
 - a) Fully open.
 - 11. Alarms – Provide an alarm for each of the following:
 - a. Fan fails to run after 30 seconds of being commanded on.
 - b. Fan fails to stop after 30 seconds of being commanded off.
 - c. Software safety trip.
 - d. Software safety lockout (4 safety trips in 3 hours).
 - e. Low or high discharge air temperatures.
 - 1) If the discharge air temperature falls below 40°F (adjustable) in heating mode, open the heating hot water control valve, close the outdoor air damper and turn off all fans.
 - f. Low or high space temperatures.
- E. ERV-1,2,3
- 1. Occupied Mode
 - a. Enable supply and exhaust EC fan motors at all times.
 - b. Occupied heating
 - 1) Modulate the duct mounted heating hot water control valve to maintain the space temperature set point.
 - c. Occupied cooling mode
 - 1) Modulate the duct mounted chilled water cooling coil control valve to maintain the space temperature set point.
 - 2. Unoccupied Modes
 - a. Sequence of operations in unoccupied mode is the same as occupied mode except the ERV shall be disabled unless there is a call for heating or cooling. Control valves shall be closed unless the ERV is enabled.
 - 3. Alarms
 - a. Fan start failure.
 - b. Fan stop failure.
 - c. High/low discharge air temps.
 - d. High/low coil entering air temps
 - e. High water level in drain pan

- f. Dirty filter
- F. Steam Cabinet Unit Heaters
 - 1. Enable and disable fan as necessary to maintain space temperature heating set point.
 - 2. Alarms
 - a. Fan start/stop failure
 - b. Space temperature high/low limits.
- G. Radiators
 - 1. Occupied heating
 - a. Modulate control valve to maintain space temperature set point.
 - 2. Unoccupied Modes:
 - a. All same as occupied mode.
 - 3. Alarms
 - a. High/low space temperature.

END OF SECTION 230993

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SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes pipe and fittings for LP steam and condensate piping:
- B. Related Requirements:
1. Section 232216 "Steam and Condensate Piping Specialties" for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

1.3 ACTION SUBMITTALS

- A. Delegated-Design Submittal:
1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
 4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
 2. Other building services.
 3. Structural members.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding: Qualify procedures and operators according to the following:
1. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
1. LP Steam Piping: 15 psig or less.
 2. Condensate Piping: 125 psig at 250 deg F.
 3. Makeup-Water Piping: 80 psig at 150 deg F.
 4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
 5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
 6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.
- C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.
- E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
1. Material Group: 1.1.
 2. End Connections: Butt welding.
 3. Facings: Raised face.
- H. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

- A. LP Steam Piping, NPS 2 and Smaller: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- B. LP Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- C. Condensate piping, NPS 2 and smaller, shall be the following:
1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- D. Condensate piping, NPS 2-1/2 and larger, shall be either of the following:
1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.2 ANCILLARY PIPING APPLICATIONS

- A. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- B. Vacuum-Breaker Piping: Outlet, same as service where installed.
- C. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.
- P. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- U. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- V. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- W. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
 - 1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
 - 2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.
- X. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- Y. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 STEAM AND CONDENSATE PIPING SPECIALTIES INSTALLATION

- A. Comply with requirements in Section 232216 "Steam and Condensate Piping Specialties" for installation requirements for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

3.5 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers and supports. Comply with requirements below for maximum spacing.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
- C. Install hangers for steel steam supply piping with the following maximum spacing:
 - 1. NPS 3/4: Maximum span, 9 feet.
 - 2. NPS 1: Maximum span, 9 feet.
 - 3. NPS 1-1/2: Maximum span, 12 feet.
 - 4. NPS 2: Maximum span, 13 feet.
 - 5. NPS 2-1/2: Maximum span, 14 feet.
 - 6. NPS 3 and Larger: Maximum span, 15 feet.
- D. Install hangers for steel steam condensate piping with the following maximum spacing:
 - 1. NPS 3/4: Maximum span, 7 feet.
 - 2. NPS 1: Maximum span, 7 feet.
 - 3. NPS 1-1/2: Maximum span, 9 feet.
 - 4. NPS 2: Maximum span, 10 feet.
 - 5. NPS 2-1/2: Maximum span, 11 feet.
 - 6. NPS 3 and Larger: Maximum span, 12 feet
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.6 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.

- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install vacuum breakers downstream from control valve, close to coil inlet connection.
- E. Install a drip leg at coil outlet.

3.8 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping," and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush system with clean water. Clean strainers.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform the following tests and inspections:
 - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure, but not less than 100 psig. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
 - 3. After hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
- E. Prepare test and inspection reports.

END OF SECTION 232213

SECTION 232216 - STEAM AND CONDENSATE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes the following piping specialties for LP steam and condensate piping:
1. Strainers.
 2. Flash tanks.
 3. Safety valves.
 4. Pressure-reducing valves.
 5. Steam traps.
 6. Thermostatic air vents and vacuum breakers.
 7. Steam and condensate meters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
1. Pressure-reducing and safety valve.
 2. Steam trap.
 3. Air vent and vacuum breaker.
 4. Flash tank.
 5. Meter.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to the following:
1. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
1. LP Steam Piping: 15 psig.
 2. Condensate Piping: 125 psig at 250 deg F.
 3. Makeup-Water Piping: 80 psig at 150 deg F.
 4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.

5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

2.2 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."
- B. Stop-Check Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Cincinnati Valve Company.
 - c. Crane Co.
 - d. Jenkins Valves.
 2. Body and Bonnet: Malleable iron.
 3. End Connections: Flanged.
 4. Disc: Cylindrical with removable liner and machined seat.
 5. Stem: Brass alloy.
 6. Operator: Outside screw and yoke with cast-iron handwheel.
 7. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
 8. Pressure Class: 250.

2.3 STRAINERS

- A. Y-Pattern Strainers:
 1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
 3. Strainer Screen: Stainless-steel, 40-mesh strainer, or perforated stainless-steel basket.
 4. Tapped blowoff plug.
 5. CWP Rating: 250-psig working steam pressure.
- B. Basket Strainers:
 1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
 3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 250-psig working steam pressure.

2.4 FLASH TANKS

- A. Shop or factory fabricated of welded steel according to ASME Boiler and Pressure Vessel Code, for 150-psig rating; and bearing ASME label. Fabricate with tappings for low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.

2.5 SAFETY VALVES

- A. Bronze Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Kunkle Valve.
 - c. Spirax Sarco, Inc.
 - d. Watts Regulator Co.
 2. Disc Material: Forged copper alloy.
 3. End Connections: Threaded inlet and outlet.
 4. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
 5. Pressure Class: 250.
 6. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 7. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
- B. Cast-Iron Safety Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Kunkle Valve.
 - c. Spirax Sarco, Inc.
 - d. Watts Regulator Co.
 2. Disc Material: Forged copper alloy with bronze nozzle.
 3. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
 4. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
 5. Pressure Class: 250.
 6. Drip-Pan Elbow: Cast iron and having threaded inlet, outlet, and drain, with threads complying with ASME B1.20.1.
 7. Exhaust Head: Cast iron and having threaded inlet and drain, with threads complying with ASME B1.20.1.
 8. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

2.6 PRESSURE-REDUCING VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong International, Inc.
 2. Hoffman Specialty.
 3. Leslie Controls, Inc.
 4. Spence Engineering Company, Inc.
 5. Spirax Sarco, Inc.
- B. ASME labeled.
- C. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.
- D. Description: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.
- E. Body: Cast iron.

- F. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.
- G. Trim: Hardened stainless steel.
- H. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.
- I. Gaskets: Non-asbestos materials.

2.7 STEAM TRAPS

- A. Thermostatic Traps:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 - 2. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
 - 3. Trap Type: Balanced-pressure.
 - 4. Bellows: Stainless steel or monel.
 - 5. Head and Seat: Replaceable, hardened stainless steel.
 - 6. Pressure Class: 125.
- B. Thermodynamic Traps:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty.
 - e. Spirax Sarco, Inc.
 - 2. Body: Stainless steel with screw-in cap.
 - 3. End Connections: Threaded.
 - 4. Disc and Seat: Stainless steel.
 - 5. Maximum Operating Pressure: 600 psig.
- C. Float and Thermostatic Traps:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 - 2. Body and Bolted Cap: ASTM A 126, cast iron.
 - 3. End Connections: Threaded.
 - 4. Float Mechanism: Replaceable, stainless steel.
 - 5. Head and Seat: Hardened stainless steel.
 - 6. Trap Type: Balanced pressure.

7. Thermostatic Bellows: Stainless steel or monel.
 8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
 9. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless-steel cage, valve, and seat.
 10. Maximum Operating Pressure: 125 psig.
- D. Inverted Bucket Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 2. Body and Cap: Cast iron.
 3. End Connections: Threaded.
 4. Head and Seat: Stainless steel.
 5. Valve Retainer, Lever, and Guide Pin Assembly: Stainless steel.
 6. Bucket: Brass or stainless steel.
 7. Strainer: Integral stainless-steel inlet strainer within the trap body.
 8. Air Vent: Stainless-steel thermostatic vent.
 9. Pressure Rating: 250 psig.

2.8 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

- A. Thermostatic Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 2. Body: Cast iron, bronze, or stainless steel.
 3. End Connections: Threaded.
 4. Float, Valve, and Seat: Stainless steel.
 5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
 6. Pressure Rating: 125 psig.
 7. Maximum Temperature Rating: 350 deg F.
- B. Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Dunham-Bush, Inc.
 - c. Hoffman Specialty.
 - d. Johnson Corporation (The).
 - e. Spirax Sarco, Inc.
 2. Body: Cast iron, bronze, or stainless steel.

3. End Connections: Threaded.
4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
5. O-Ring Seal: EPR.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

2.9 FLEXIBLE CONNECTORS

A. Stainless-Steel Bellows, Flexible Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Duraflex, Inc.
 - b. Flexicraft Industries.
 - c. Hyspan Precision Products, Inc.
 - d. Mason Industries, Inc.
 - e. Metraflex Company (The).
 - f. Twin City Hose, Inc.
2. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, protective jacket.
3. End Connections: Threaded or flanged to match equipment connected.
4. Performance: Capable of 3/4-inch misalignment.
5. CWP Rating: 150 psig.
6. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
- B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.2 PIPING INSTALLATION

- A. Install piping to permit valve servicing.
- B. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- D. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- E. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- F. Install shutoff valve immediately upstream of each dielectric fitting.

- G. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- H. Flash Tank:
1. Pitch condensate piping down toward flash tank.
 2. If more than one condensate pipe discharges into flash tank, install a check valve in each line.
 3. Install thermostatic air vent at tank top.
 4. Install safety valve at tank top.
 5. Install full-port ball valve, and swing check valve on condensate outlet.
 6. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the calculated heat load.
 7. Install pressure gage on low-pressure steam outlet according to Section 230519 "Meters and Gages for HVAC Piping."

3.3 STEAM-TRAP INSTALLATION

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.4 PRESSURE-REDUCING VALVE INSTALLATION

- A. Install pressure-reducing valves in accessible location for maintenance and inspection.
- B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
- C. Install gate valves on both sides of pressure-reducing valves.
- D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections, respectively.
- E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Section 230519 "Meters and Gages for HVAC Piping."
- F. Install strainers upstream for pressure-reducing valve.
- G. Install safety valve downstream from pressure-reducing valve station.

3.5 SAFETY VALVE INSTALLATION

- A. Install safety valves according to ASME B31.9, "Building Services Piping."
- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Install traps and control valves in accessible locations close to connected equipment.
- B. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

- C. Install vacuum breakers downstream from control valve, close to coil inlet connection.

END OF SECTION 232216

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Single-wall rectangular ducts and fittings.
 2. Single-wall round and flat-oval ducts and fittings.
 3. Sheet metal materials.
 4. Sealants and gaskets.
 5. Hangers and supports.
- B. Related Sections:
1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
1. Sealants and gaskets.
 2. Seismic-restraint devices.
- B. Shop Drawings:
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 2. Factory- and shop-fabricated ducts and fittings.
 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 4. Elevation of top of ducts.
 5. Fittings.
 6. Reinforcement and spacing.
 7. Seam and joint construction.
 8. Equipment installation based on equipment being used on Project.
 9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 10. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- C. Delegated-Design Submittal:
1. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Minimum sheet metal thickness shall be 26 ga.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
1. Minimum sheet metal thickness shall be 26 ga.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 9. VOC: Maximum 395 g/L.
 10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 12. Service: Indoor or outdoor.
 13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.

- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Test for leaks before applying external insulation.
 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 6. Give seven days' advance notice for testing.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Retain applicable subparagraphs in this article to set criteria for pressure class, duct seal-class level, and duct-leakage class; or delete applicable subparagraphs and indicate pressure class, duct seal-class level, and duct-leakage class on Drawings. If retaining duct seal and leakage requirements in this article, retain first paragraph in "Duct Sealing" Article. Both seal class and leakage class are included in this article and either one can be deleted, or both can remain if they are consistent.
- C. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- D. Return Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- E. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

- F. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- G. Intermediate Reinforcement:
 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.
- H. Liner:
 1. Supply Air Ducts: Flexible elastomeric, 1 inch thick.
 2. Return Air Ducts: Flexible elastomeric, 1 inch thick.
 3. Exhaust Air Ducts: Flexible elastomeric, 1 inch thick.
 4. Transfer Ducts: Flexible elastomeric, 1 inchthick.
- I. Elbow Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- J. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

- a. Rectangular Main to Rectangular Branch: 45-degree entry.
- b. Rectangular Main to Round Branch: Spin in.
- 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Backdraft and pressure relief dampers.
 2. Manual volume dampers.
 3. Control dampers.
 4. Fire dampers.
 5. Turning vanes.
 6. Duct-mounted access doors.
 7. Flexible connectors.
 8. Flexible ducts.
 9. Duct accessory hardware.
- B. Related Requirements:
1. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Lloyd Industries, Inc.
 - 6. Nailor Industries Inc.
 - 7. NCA Manufacturing, Inc.
 - 8. Pottorff.
 - 9. Ruskin Company.
 - 10. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm
- D. Frame: Hat-shaped, 0.05-inch- thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- E. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- F. Blade Action: Parallel.

- G. Blade Seals: Extruded vinyl, mechanically locked.
- H. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- I. Return Spring: Adjustable tension.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. Nailor Industries Inc.
 - f. Pottorff.
 - g. Ruskin Company.
 - h. Trox USA Inc.
 - i. Vent Products Company, Inc.
 - 2. Standard leakage rating.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
 - 1. Size: 0.5-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Greenheck Fan Corporation.
 5. Lloyd Industries, Inc.
 6. McGill AirFlow LLC.
 7. Metal Form Manufacturing, Inc.
 8. Nailor Industries Inc.
 9. NCA Manufacturing, Inc.
 10. Pottorff.
 11. Ruskin Company.
 12. Vent Products Company, Inc.
 13. Young Regulator Company.
- B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Hat shaped.
 2. 0.094-inch- thick, galvanized sheet steel.
 3. Mitered and welded corners.
- D. Blades:
1. Multiple blade with maximum blade width of 8 inches.
 2. Parallel- and opposed-blade design.
 3. Galvanized-steel.
 4. 0.064 inch thick single skin.
 5. Blade Edging: Closed-cell neoprene.
 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
1. Stainless-steel sleeve.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Air Balance Inc.; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Greenheck Fan Corporation.
 5. Nailor Industries Inc.
 6. NCA Manufacturing, Inc.

7. Pottorff.
 8. Prefco; Perfect Air Control, Inc.
 9. Ruskin Company.
 10. Vent Products Company, Inc.
 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Fire Rating: 1-1/2 and 3 hours.
- D. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- J. Heat-Responsive Device: replaceable link and switch package, factory installed, 165 deg F rated.

2.7 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Elgen Manufacturing.
 4. METALAIRE, Inc.
 5. SEMCO Incorporated.
 6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.
- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.8 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Cesco Products; a division of Mestek, Inc.
 3. Ductmate Industries, Inc.
 4. Elgen Manufacturing.
 5. Flexmaster U.S.A., Inc.
 6. Greenheck Fan Corporation.
 7. McGill AirFlow LLC.
 8. Nailor Industries Inc.
 9. Pottorff.
 10. Ventfabrics, Inc.
 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.9 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Elgen Manufacturing.
 4. Ventfabrics, Inc.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. 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/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz./sq. yd..
 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg 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/inch in the warp and 340 lbf/inch in the filling.
 3. Service Temperature: Minus 67 to plus 500 deg 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-inch movement at start and stop.

2.10 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 175 deg F.
 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or Nylon strap in sizes 3 through 18 inches, to suit duct size.
 2. Non-Clamp Connectors: Adhesive.

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. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- I. Connect ducts to duct silencers with flexible duct connectors.
- J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.

8. Upstream or downstream from duct silencers.
 9. Control devices requiring inspection.
 10. Elsewhere as indicated.
- K. Install access doors with swing against duct static pressure.
- L. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- M. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- N. Install flexible connectors to connect ducts to equipment.
- O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- P. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- Q. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- R. Connect flexible ducts to metal ducts with adhesive and draw bands.
- S. Install duct test holes where required for testing and balancing purposes.
- T. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

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. Fan-powered air terminal units.
 - 2. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
 - 1. Air terminal units.
 - 2. Liners and adhesives.
 - 3. Sealants and gaskets.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Delegated-Design Submittal:
 - 1. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 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 assembly members.
 - 2. Size and location of initial access modules for acoustic tile.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Instructions for resetting minimum and maximum air volumes.
 - 2. Instructions for adjusting software set points.

1.6 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. Fan-Powered-Unit Filters: Furnish one spare filter for each filter installed.

1.7 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS**2.1 SYSTEM DESCRIPTION**

- 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.

2.2 PARALLEL FAN-POWERED AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Anemostat Products; a Mestek Company.
 2. Carnes.
 3. Price Industries.
 4. Titus.
- B. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.034-inch steel, single wall.
1. Casing Lining: Adhesive attached, 3/4-inch- thick, 1-1/2 lb. density, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 5. Fan: Forward-curved centrifugal, located at plenum air inlet.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 6-inch wg inlet static pressure.
 2. Damper Position: Normally closed.
- E. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
- F. Motor:

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 2. Type: Permanent-split capacitor with SCR for speed adjustment.
 3. Fan-Motor Assembly Isolation: Rubber isolators.
 4. Enclosure: Open dripproof.
 5. Enclosure Materials: Rolled steel.
- G. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
1. Location: Plenum air inlet.
 2. Stages: 2.
 3. Access door interlocked disconnect switch.
 4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 5. Nickel chrome 80/20 heating elements.
 6. Airflow switch for proof of airflow.
 7. Fan interlock contacts.
 8. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 9. Mercury contactors.
 10. Pneumatic-electric switches and relays.
 11. Magnetic contactor for each step of control (for three-phase coils).
- H. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.
1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
 2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
 3. Disconnect Switch: Factory-mounted, fuse type.
- I. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.
- J. Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Section 230900 "Instrumentation and Control for HVAC" and shall have the following features:
1. Occupied and unoccupied operating mode.
 2. Remote reset of airflow or temperature set points.
 3. Adjusting and monitoring with portable terminal.
 4. Communication with temperature-control system specified in Section 230900 "Instrumentation and Control for HVAC."

2.3 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Steel Cables: Galvanized steel complying with ASTM A 603.

- C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to ARI 880.
 - 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- C. Connect ducts to air terminal units according to [Section 233113 "Metal Ducts."

- D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform Tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Air terminal unit will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.6 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. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 3. Verify that controls and control enclosure are accessible.
 4. Verify that control connections are complete.
 5. Verify that nameplate and identification tag are visible.
 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Rectangular and square ceiling diffusers.
- B. Related Sections:
1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

1.4 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 assembly members.
 2. Method of attaching hangers to building structure.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 5. Duct access panels.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Anemostat Products; a Mestek company.

- b. [Krueger.](#)
- c. [METALAIRE, Inc.](#)
- d. [Nailor Industries Inc.](#)
- e. [Price Industries.](#)
- f. [Titus.](#)

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 26 0010 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements applicable to Work specified in Division 26.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. A: Ampere, unit of electrical current.
2. AC or ac: Alternating current.
3. AIC: Ampere interrupting capacity.
4. AL, Al, or ALUM: Aluminum.
5. ASD: Adjustable-speed drive.
6. AWG: American wire gauge; see ASTM B258.
7. CAD: Computer-aided design or drafting.
8. CB: Circuit breaker.
9. CO/ALR: Copper-aluminum, revised.
10. CU or Cu: Copper.
11. CU-AL or AL-CU: Copper-aluminum.
12. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
13. DC or dc: Direct current.
14. EGC: Equipment grounding conductor.
15. fc: Footcandle, a unit of illuminance equal to one lumen per square foot.
16. FLC: Full-load current.
17. ft: Foot.
18. GEC: Grounding electrode conductor.
19. GFCI: Ground-fault circuit interrupter.
20. GND: Ground.
21. HACR: Heating, air conditioning, and refrigeration.
22. HDPE: High-density polyethylene.
23. HP or hp: Horsepower.
24. HVAC: Heating, ventilating, and air conditioning.
25. Hz: Hertz.
26. kAIC: Kiloampere interrupting capacity.
27. kcmil or MCM: One thousand circular mils.
28. kV: Kilovolt.
29. kVA: Kilovolt-ampere.
30. kW: Kilowatt.
31. LAN: Local area network.
32. lb: Pound (weight).
33. LCD: Liquid-crystal display.
34. LED: Light-emitting diode.
35. MLO: Main lugs only.
36. NC: Normally closed.
37. NiCd: Nickel cadmium.
38. NO: Normally open.
39. OCPD: Overcurrent protective device.

- 40. PF or pf: Power factor.
- 41. PLFA: Power-limited fire alarm.
- 42. PoE: Power over Ethernet.
- 43. SPD: Surge protective device.
- 44. sq.: Square.
- 45. SWD: Switching duty.
- 46. TR: Tamper resistant.
- 47. UL: Underwriters Laboratories, Inc. (standards) or UL LLC (services).
- 48. V: Volt, unit of electromotive force.
- 49. V(ac): Volt, alternating current.
- 50. VA: Volt-ampere, unit of complex electrical power.
- 51. W: Watt, unit of real electrical power.
- 52. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

- 1. EMT: Electrical metallic tubing.
- 2. EPEC-40: Schedule 40 electrical HDPE underground conduit.
- 3. EPEC-80: Schedule 80 electrical HDPE underground conduit.
- 4. EPEC-A: Type A electrical HDPE underground conduit.
- 5. ERMCM: Electrical rigid metal conduit.
- 6. ERMCM-S: Steel electrical rigid metal conduit.
- 7. ERMCM-S-G: Galvanized-steel electrical rigid metal conduit.
- 8. FMC: Flexible metal conduit.
- 9. FMC-A: Aluminum flexible metal conduit.
- 10. FMT: Steel flexible metallic tubing.
- 11. FNMC: Flexible nonmetallic conduit. See LFNC.
- 12. HDPE: See EPEC.
- 13. IMC: Steel electrical intermediate metal conduit.
- 14. LFMC: Liquidtight flexible metal conduit.
- 15. LFMC-A: Aluminum liquidtight flexible metal conduit.
- 16. LFMC-S: Steel liquidtight flexible metal conduit.
- 17. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
- 18. LFNC: Liquidtight flexible nonmetallic conduit.
- 19. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
- 20. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
- 21. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
- 22. PVC: Rigid PVC conduit.
- 23. PVC-40: Schedule 40 rigid PVC conduit.
- 24. PVC-80: Schedule 80 rigid PVC Conduit.
- 25. PVC-A: Type A rigid PVC concrete-encased conduit.
- 26. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
- 27. RGS: See ERMCM-S-G.
- 28. RMC: See ERMCM.
- 29. RTRC: Reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Cable Types:

- 1. AC: Armored cable.
- 2. CATV: Coaxial general-purpose cable.
- 3. CATVP: Coaxial plenum cable.
- 4. CATVR: Coaxial riser cable.
- 5. CI: Circuit integrity cable.

6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-HL: Metal-clad cable, hazardous location.
31. MI: Mineral-insulated, metal-sheathed cable.
32. MTW: Moisture-, heat-, and oil-resistant thermoplastic cable (machine tool wiring).
33. MV: Medium-voltage cable.
34. NM: Nonmetallic sheathed cable.
35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
37. NPLF: Non-power-limited fire-alarm circuit cable.
38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
40. NUCC: Nonmetallic underground conduit with conductors.
41. OFC: Conductive optical fiber general-purpose cable.
42. OFCG: Conductive optical fiber general-purpose cable.
43. OFCP: Conductive optical fiber plenum cable.
44. OFCR: Conductive optical fiber riser cable.
45. OFN: Nonconductive optical fiber general-purpose cable.
46. OFNG: Nonconductive optical fiber general-purpose cable.
47. OFNP: Nonconductive optical fiber plenum cable.
48. OFNR: Nonconductive optical fiber riser cable.
49. P: Marine shipboard cable.
50. PLTC: Power-limited tray cable.
51. PLTC-ER: Power-limited tray cable, exposed run.
52. PV: Photovoltaic cable.
53. RHH: Thermoset rubber, heat-resistant cable (high heat).
54. RHW: Thermoset rubber, moisture-resistant cable.
55. SA: Silicone rubber cable.

- 56. SE: Service-entrance cable.
- 57. SER: Service-entrance cable, round.
- 58. SEU: Service-entrance cable, flat.
- 59. SIS: Thermoset cable for switchboard and switchgear wiring.
- 60. TBS: Thermoplastic cable with outer braid.
- 61. TC: Tray cable.
- 62. TC-ER: Tray cable, exposed run.
- 63. TC-ER-HL: Tray cable, exposed run, hazardous location.
- 64. THW: Thermoplastic, heat- and moisture-resistant cable.
- 65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
- 66. THHW: Thermoplastic, heat- and moisture-resistant cable.
- 67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
- 68. TW: Thermoplastic, moisture-resistant cable.
- 69. UF: Underground feeder and branch-circuit cable.
- 70. USE: Underground service-entrance cable.
- 71. XHH: Cross-linked polyethylene, heat-resistant cable.
- 72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Definitions:

- 1. Basic Impulse Insulation Level: Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
- 2. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
- 3. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
- 4. Designated Seismic System: A system component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.
- 5. Direct Buried: Installed underground without encasement in concrete or other protective material.
- 6. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
 - b. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - c. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
 - d. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 - e. Device Box: A box with provisions for mounting a wiring device directly to the box.
 - f. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 - g. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.

- h. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 - i. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
 - j. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 - k. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 - l. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 - m. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
7. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
8. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
9. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
10. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
11. Sheath: A continuous metallic covering for conductors or cables.
12. UL Category Control Number: An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
13. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
- a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
 - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
 - c. Extra-Low Voltage: Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
 - d. Low Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
 - e. Medium Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.

1.3 COORDINATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:
- 1. Notify Construction Manager & Owner no fewer than seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
 - a. Emergency lighting.
 - b. Elevators.
 - c. Fire-alarm systems.

1.4 SEQUENCING

- A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

1.5 ACTION SUBMITTALS

- A. Coordination Drawings for Ceiling Areas: Where indicated on drawings, provide reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 013100 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Suspended ceiling components.
 2. Size and location of access panels on ceilings.
 3. Luminaires.
 4. Communications devices.
 5. Speakers.
 6. Security devices.
 7. Fire-alarm devices.
- B. Coordination Drawings for Conduit Routing: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
 1. Submission of action submittals specified in Division 26.
 2. Orders placed for major electrical equipment.
 3. Arrival of major electrical equipment on-site.
 4. Preinstallation meetings specified in Division 26.
 5. Closing of walls and ceilings containing electrical Work.
 6. System startup, testing, and commissioning activities for major electrical equipment.
 7. System startup, testing, and commissioning activities for emergency lighting.
 8. Requests for inspections by authorities having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

- A. Facility EPM Program Binders:
 1. Complete Set: On approved online or cloud solution and USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement.

2. Include the following information:
 - a. Manufacturer's operating specifications.
 - b. User's guides for software and hardware.
 - c. Schedule of maintenance material items recommended to be stored at Project site.
 - d. Detailed instructions covering operation under both normal and abnormal conditions.
 - e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
 - f. List of load-current and overload-relay heaters with related motor nameplate data.
 - g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
 - h. Manufacturer's instructions for setting field-adjustable components.
 - i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
 - j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.
 - k. Exterior pole inspection and repair procedures.

1.8 QUALIFICATIONS

- A. Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 1. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.
- B. Control-Voltage Electrical Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 1. On-site control-voltage testing supervisor must have BICSI Registered Communications Distribution Designer certification and documented training and experience with testing control-voltage equipment in accordance with NETA testing standards.

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:
 1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
 2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
 3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION**3.1 INSTALLATION OF ELECTRICAL WORK**

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

3.2 FIELD QUALITY CONTROL

- A. Adminstrant for Low-Voltage Electrical Tests and Inspections:
 - 1. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- B. Adminstrant for Control-Voltage Electrical Tests and Inspections:
 - 1. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- C. Adminstrant for Field Tests and Inspections of Lighting Installations:
 - 1. Administer and perform tests and inspections with assistance of factory-authorized service representative.

3.3 CLOSEOUT ACTIVITIES

- A. Demonstration:
 - 1. With assistance from factory-authorized service representatives, demonstrate to Owner's maintenance and clerical personnel and building occupants how to operate the following systems and equipment:
 - a. Lighting control devices specified in Section 260923 "Network Lighting Controls."
- B. Training:
 - 1. With assistance from factory-authorized service representatives, train Owner's maintenance personnel on the following topics:
 - a. How to adjust, operate, and maintain devices specified in Section 260923 "Network Lighting Controls."

END OF SECTION 26 0010

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire.
 - 2. Metal-clad cable, Type MC.
 - 3. Fire-alarm wire and cable.
 - 4. Connectors and splices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Bare Conductor.
 - 2. General Cable; Prysmian Group North America.
 - 3. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type NM: Comply with UL 83 and UL 719.
 - 2. Type THHN and Type THWN-2: Comply with UL 83.
 - 3. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems; Atkore International.
 - 2. Alpha Wire Company.
 - 3. American Bare Conductor.
 - 4. Belden Inc.
 - 5. General Cable; Prysmian Group North America.
 - 6. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. RoHS compliant.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 - 1. Single circuit and multicircuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

2.3 FIRE-ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Wire & Cable Inc.
 - 2. Genesis Cable Products; Honeywell International, Inc.

3. Superior Essex Inc.
4. West Penn Wire.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
 1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire-alarm and cable tray installation, plenum rated.

2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. 3M Electrical Products.
 2. AFC Cable Systems; Atkore International.
 3. Hubbell Incorporated, Power Systems.
 4. Ideal Industries, Inc.
 5. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 6. Service Wire Co.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 1. Material: Copper.
 2. Type: One hole with standard barrels.
 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits:
 - 1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - 2. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
- C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."
 - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
 - 2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system.
 - a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
 - 3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is not permitted.
 - 4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.

- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- D. Comply with requirements in Section 283111 "Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. Administrant for Tests and Inspections:
 - 1. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- B. Tests and Inspections:
 - 1. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Related Requirements:
 - 1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Burndy; Hubbell Incorporated, Construction and Energy.
 - 3. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - 4. Siemens Industry, Inc., Energy Management Division.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- C. Compression-Type Bus-Bar Connectors: Copper or copper alloy, with two wire terminals.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
- I. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- J. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- D. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft. apart.
- E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- B. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

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SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 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 the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. B-line; Eaton, Electrical Sector.
 - c. CADDY; nVent.
 - d. Unistrut; Atkore International.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel.
4. Channel Width: 1-5/8 inch.
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-

- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line; Eaton, Electrical Sector.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
 - 6. Toggle Bolts: All steel springhead type.
 - 7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as scheduled in NECA NEIS 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size must be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 INSTALLATION OF SUPPORTS

- A. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT and ERMC may be supported by openings through structure members, in accordance with NFPA 70.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

3.4 PAINTING

- A. Touchup:

1. Comply with requirements in Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY**A. Section Includes:**

1. Type EMT raceways and elbows.
2. Type ERMC raceways, elbows, couplings, and nipples.
3. Type LFNC raceways.
4. Fittings for conduit, tubing, and cable.
5. Threaded metal joint compound.
6. Solvent cements.
7. Surface metal raceways and fittings.
8. Wireways and auxiliary gutters.
9. Metallic outlet boxes, device boxes, rings, and covers.
10. Termination boxes.
11. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.
12. Cover plates for device boxes.

B. Related Requirements:

1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 27 0528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS**A. Product Data:** For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Cabinets, cutout boxes, and miscellaneous enclosures.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details. Show that floor boxes are located to avoid interferences and are structurally allowable.

PART 2 - PRODUCTS

2.1 TYPE EMT RACEWAYS AND ELBOWS**A. Performance Criteria:**

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797 and UL Category Control Number FJMX.

B. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Allied Tube & Conduit; Atkore International.
 - b. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - c. Wheatland Tube; Zekelman Industries.
2. Material: Steel.
 3. Options:
 - a. Interior Coating: Zinc with organic top coating.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.2 TYPE ERM C RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 6 and UL Category Control Number DYIX.

B. Galvanized-Steel Electrical Rigid Metal Conduit (ERM C-S-G), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - d. Wheatland Tube; Zekelman Industries.
2. Exterior Coating: Zinc.
3. Options:
 - a. Interior Coating: Zinc.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.3 TYPE LFNC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 1660 and UL Category Control Number DXOQ.

B. Layered (Type A) Liquidtight Flexible Nonmetallic Conduit (LFNC-A):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFC Cable Systems; Atkore International.
 - b. Electri-Flex Company.
 - c. Topaz Lighting & Electric.
2. Additional Criteria: Type A conduit with smooth seamless inner core and cover bonded together with one or more reinforcement layers between core and cover.
3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: 80 deg C dry.

2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Fittings for Type EMT Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Calconduit; Atkore International.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Southwire Company.
 - f. Topaz Lighting & Electric.
2. General Characteristics: UL 514B and UL Category Control Number FKAV.
3. Options:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

C. Fittings for Type LFMC and Type LFNC Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Liquid Tight Connector Co.
2. General Characteristics: UL 514B and UL Category Control Number DXAS.

2.5 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 5 and UL Category Control Number RJBT.

B. Surface Metal Raceways and Fittings with Metal Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MonoSystems, Inc.
 - b. Wiremold; Legrand North America, LLC.
 - c. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
2. Options:
 - a. Galvanized steel base with snap-on covers.
 - b. Manufacturer's standard enamel finish in color white.
 - c. Wiring Channels: Single. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.

2.6 WIREWAYS AND AUXILIARY GUTTERS**A. Performance Criteria:**

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 870 and UL Category Control Number ZOYX.

B. Metal Wireways and Auxiliary Gutters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Hoffman; nVent.
 - d. Square D; Schneider Electric USA.
 - e. Wiegmann; Hubbell Incorporated, Commercial and Industrial.
2. Additional Characteristics:
 - a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - b. Finish: Manufacturer's standard enamel finish.
3. Options:
 - a. Degree of Protection: Type 1 unless otherwise indicated.
 - b. Wireway Covers: Screw-cover type unless otherwise indicated.

2.7 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS**A. Performance Criteria:**

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; Eaton, Electrical Sector.
 - b. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - c. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
 - e. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
3. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: Minimum 2 inch.

- c. Cast-Metal Depth: Minimum 2.4 inch.
 - d. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.
- C. Metallic Conduit Bodies:
 - 1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; Eaton, Electrical Sector.
 - b. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. Pass & Seymour; Legrand North America, LLC.
- D. Metallic Device Boxes:
 - 1. Description: Box with provisions for mounting wiring device directly to box.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; Eaton, Electrical Sector.
 - b. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - c. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
 - 3. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: minimum 2.5 inch.
 - c. Cast-Metal Depth: minimum 2.4 inch.
- E. Metallic Extension Rings:
 - 1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
 - e. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2.8 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Hoffman; nVent.
 - c. Milbank Manufacturing Co.
 - d. Square D; Schneider Electric USA.
 2. Additional Characteristics: Listed and labeled for installation on line side of service equipment.

2.9 CABINETS, CUTOOT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.
- B. Indoor Sheet Metal Cabinets:
 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. Hoffman; nVent.
 - d. Milbank Manufacturing Co.
 - e. Square D; Schneider Electric USA.
 3. Additional Characteristics: UL Category Control Number CYIV.
 4. Options:
 - a. Degree of Protection: Type 1.
- C. Indoor Sheet Metal Cutout Boxes:
 1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. Hoffman; nVent.
 - d. Milbank Manufacturing Co.
 - e. Square D; Schneider Electric USA.

3. Additional Characteristics: UL Category Control Number CYIV.
 4. Options:
 - a. Degree of Protection: Type 1.
- D. Indoor Sheet Metal Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Hoffman; nVent.
 - c. Milbank Manufacturing Co.
 - d. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Square D; Schneider Electric USA.
 3. Additional Characteristics: UL Category Control Number BGUZ.
 4. Options:
 - a. Degree of Protection: Type 1.
- E. Indoor Cast-Metal Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adalet.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 3. Additional Characteristics: UL Category Control Number BGUZ.
 4. Options:
 - a. Degree of Protection: Type 1.
- F. Indoor Sheet Metal Miscellaneous Enclosures:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Hoffman; nVent.
 - c. Milbank Manufacturing Co.
 - d. Square D; Schneider Electric USA.
 2. Additional Characteristics: UL 1773 and UL Category Control Number XCKT.
 3. Options:
 - a. Degree of Protection: Type 1.
- G. Outdoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. Hoffman; nVent.
 - d. Milbank Manufacturing Co.
 - e. Square D; Schneider Electric USA.
3. Additional Characteristics: UL Category Control Number CYIV.
4. Options:
 - a. Degree of Protection: Type 3R.

H. Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. Hoffman; nVent.
 - c. Hubbell Industrial Controls; Hubbell Incorporated, Commercial and Industrial.
 - d. Milbank Manufacturing Co.
 - e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Square D; Schneider Electric USA.
3. Additional Characteristics: UL Category Control Number BGUZ.
4. Options:
 - a. Degree of Protection: Type 3R.

I. Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adalet.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
3. Additional Characteristics: UL Category Control Number BGUZ.
4. Options:
 - a. Degree of Protection: Type 3R.

2.10 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics:
 - a. Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - b. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- B. Metallic Cover Plates for Device Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; Eaton, Electrical Sector.
 - b. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - c. Leviton Manufacturing Co., Inc.
 - d. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Panduit Corp.
 - f. Pass & Seymour; Legrand North America, LLC.
 - g. Wiremold; Legrand North America, LLC.
 - h. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
 2. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wallplate Material: 0.032 inch thick Type 302/304 non-magnetic stainless steel with brushed finish.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
1. Exposed and Subject to Severe Physical Damage: ERM C.
 2. Exposed and Subject to Physical Damage: ERM C.
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 3. Exposed and Not Subject to Physical Damage: ERM C.
 4. Concealed Aboveground: ERM C.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
- C. Indoors:
1. Hazardous Classified Locations: ERM C.
 2. Exposed and Subject to Severe Physical Damage: ERM C. Subject to severe physical damage includes the following locations:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

- c. Mechanical rooms.
- 3. Exposed and Subject to Physical Damage: ERM. Subject to physical damage includes the following locations:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
- 4. Exposed and Not Subject to Physical Damage: EMT.
- 5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 6. Damp or Wet Locations: ERM.
- 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
- D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
 - 1. ERM and IM: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - b. Locations Exposed to Hosedown: Type 4.
 - c. Locations Subject to Potential Flooding: Type 6P.
 - 2. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 12.
- C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
 - 1. Provide cast-metal boxes.
 - 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

- A. Installation Standards:
 - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
 - 2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
 - 3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
 - 4. Comply with NECA NEIS 101 for installation of steel raceways.
 - 5. Comply with NECA NEIS 102 for installation of aluminum raceways.
 - 6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.

7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts..
 9. Raceway Terminations at Locations Subject to Moisture or Vibration:
- B. General Requirements for Installation of Raceways:
1. Complete raceway installation before starting conductor installation.
 2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
 3. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
 4. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 5. Support conduit within 12 inch of enclosures to which attached.
 6. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by NFPA 70.
 7. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
 8. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
 9. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 10. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- C. Requirements for Installation of Specific Raceway Types:
1. Types EMT:
 - a. Do not install aluminum raceways or fittings in contact with concrete or earth.
 2. Types ERMCM:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to

threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

3. Types FMC:
 - a. Comply with NEMA RV 3. Provide a maximum of 72 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- D. Stub-ups to Above Recessed Ceilings:
 1. Provide EMT for raceways.
 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- E. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
 1. ERM-C-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 2. EMT: Provide compression, fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
- F. Expansion-Joint Fittings:
 1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERM-C and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
 2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 4. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- G. Raceways Penetrating Rooms or Walls with Acoustical Requirements:
 1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceway with a minimum 2 inch radius control at bend points.

- B. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- K. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 26 0533

SECTION 26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND
CABLING

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. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

- B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

- A. Wall Sleeves, Steel:

1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

- B. Wall Sleeves, Cast Iron:

1. Description: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

- C. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 SLEEVE SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

2.4 POURABLE SEALANTS

- A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.5 FOAM SEALANTS

- A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 INSTALLATION OF SLEEVE SEAL SYSTEMS

- A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 26 0544

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SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
1. Black letters on an orange field.
 2. Legend: Indicate voltage.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less:

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Color for Neutral: White.
 4. Color for Equipment Grounds: Green.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
1. Black letters on an orange field.
 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
- F. Equipment Identification Labels:
1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 - e. Panduit Corp.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. HellermannTyton.
 - c. Marking Services, Inc.
 - d. Panduit Corp.
 - e. Seton Identification Products; a Brady Corporation company.

- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Brother International Corporation.
 - c. emedco.
 - d. Ideal Industries, Inc.
 - e. LEM Products Inc.
 - f. Panduit Corp.
 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 3. Marker for Labels:
 - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. HellermannTyton.
 - d. Ideal Industries, Inc.
 - e. LEM Products Inc.
 - f. Panduit Corp.
 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. HellermannTyton.
 - c. Marking Services, Inc.
 - d. Panduit Corp.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brady Corporation.
- b. Panduit Corp.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Carlton Industries, LP.
- b. Champion America.
- c. HellermannTyton.
- d. Ideal Industries, Inc.
- e. Marking Services, Inc.
- f. Panduit Corp.

- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brady Corporation.
- b. Carlton Industries, LP.
- c. emedco.
- d. Marking Services, Inc.

- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brimar Industries, Inc.
- b. HellermannTyton.
- c. LEM Products Inc.
- d. Marking Services, Inc.
- e. Seton Identification Products; a Brady Corporation company.

- D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brady Corporation.
- b. Carlton Industries, LP.
- c. emedco.

- d. Marking Services, Inc.
 - e. Seton Identification Products; a Brady Corporation company.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. LEM Products Inc.
 - d. Panduit Corp.
 - e. Seton Identification Products; a Brady Corporation company.
- C. Write-on Tags:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Carlton Industries, LP.
 - c. LEM Products Inc.
 - d. Seton Identification Products; a Brady Corporation company.
 - 2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
 - 3. Marker for Tags:
 - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

- A. Baked-Enamel Signs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Champion America.
 - c. emedco.
 - d. Marking Services, Inc.
 - 2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 3. 1/4-inch grommets in corners for mounting.
 - 4. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Champion America.
 - c. emedco.

- d. Marking Services, Inc.
 2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
 3. 1/4-inch grommets in corners for mounting.
 4. Nominal Size: 10 by 14 inches.
- C. Laminated Acrylic or Melamine Plastic Signs:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, L.P.
 - c. emedco.
 - d. Marking Services, Inc.
 2. Engraved legend.
 3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. HellermannTyton.
 2. Ideal Industries, Inc.
 3. Marking Services, Inc.
 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
- K. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- M. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Labels:
 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- R. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Metal Tags:
 1. Place in a location with high visibility and accessibility.
 2. Secure using general-purpose cable ties.
- U. Nonmetallic Preprinted Tags:
 1. Place in a location with high visibility and accessibility.
 2. Secure using plenum-rated cable ties.
- V. Write-on Tags:
 1. Place in a location with high visibility and accessibility.
 2. Secure using plenum-rated cable ties.
- W. Baked-Enamel Signs:
 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- X. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- Y. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- Z. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
 2. "POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors.
- I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 1. Apply to exterior of door, cover, or other access.
 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- M. Operating Instruction Signs: Baked-enamel warning signs.
- N. Equipment Identification Labels:
 1. Indoor Equipment: Baked-enamel signs.
 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Circuit breakers in existing panelboard schedules.
 - e. Enclosed switches.
 - f. Enclosed circuit breakers.
 - g. Enclosed controllers.
 - h. Variable-speed controllers.
 - i. HVAC Starters and disconnect switches.
 - j. Smoke and Heat detectors.
 - k. Fire Alarm Pull Stations.
 - l. Fire Alarm Visual and audio/visual devices.
 - m. Push-button stations.
 - n. Contactors.

END OF SECTION 26 0553

SECTION 26 0943 - NETWORK LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components:
1. System Software Interfaces
 - a. Management Interface
 - b. Historical Database and Analytics Interface
 - c. Visualization Interface
 - d. Personal Control Applications
 - e. Smartphone Programming Interface for wired devices
 2. System Backbone and Integration Equipment
 - a. System Controller
 - b. OpenADR Interface
 3. Wired Networked Devices
 - a. Wall Stations
 - b. Digital Key Switches
 - c. Auxiliary Input/Output Devices
 - d. Occupancy and Photocell Sensors
 - e. Wall Switch Sensors
 - f. Embedded Sensors
 - g. Power Packs and Secondary Packs
 - h. Networked Luminaires
 - i. Relay and Dimming Panel
 - j. Bluetooth® Low Energy Programming Device
 - k. Communication Bridge
- B. The networked lighting control system shall meet all of the characteristics and performance requirements specified herein.
- C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 RELATED DOCUMENTS

- A. Section 26 5100 Interior Lighting

1.3 SUBMITTALS

- A. Submittal shall be provided including the following items.
1. Bill of Materials necessary to install the networked lighting control system.
 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 3. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
 4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.

5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
8. Hardware and Software Operation Manuals.

1.4 QUALITY ASSURANCE

A. Product Qualifications

1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. Installation and Startup Qualifications

1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements

1. Phone Support: Toll free technical support shall be available.
2. Remote Support: The bidder shall offer a remote support capability.
3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.5 PROJECT CONDITIONS

A. Only install equipment after the following site conditions are maintained:

1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
2. Relative Humidity: less than 90% non-condensing

B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above, at any point prior to installation.

C. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

1.6 WARRANTY

- A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.7 MAINTENANCE & SUSTAINABILITY

- A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 – EQUIPMENT**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers Acuity Brands Lighting, Inc or equal.

2.2 SYSTEM COMPLIANCE

- A. System components shall comply with UL 916 and UL 924 standards where applicable.
- B. System components shall comply with CFR Title 47, Part 15 standards where applicable.
- C. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture
 - 1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation between control zones.
 - 2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
 - 3. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).
 - 4. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”
 - a. Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.

5. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
7. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
8. The system may include one or more system controllers that provide time-based control and global system control across multiple control zones and backbone network segments. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
9. The system may include “communication bridge” devices that route communication from lighting control zones (wired or wireless) to and from the system controller, for purposes of decreasing system wiring requirements.
10. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.

B. Wired Networked Control Zone Characteristics

1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
2. Devices in an area shall be connected via a “daisy-chain” topology; requiring all individual networked devices to be connected back to a central component in a “hub-and-spoke” topology shall not be permitted, so as to reduce the total amount of network cable required for each control zone.
3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.
4. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

7. Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
 - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:
 - a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.
 - b. The system shall support reading of individual device status information. The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.
 - c. The system shall support activation of pre-defined system Global Profiles (see *Supported Sequence of Operations for further definition of Global Profile capabilities*).
2. The system shall support activation of Profiles (local or global) and Preset Scenes from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See *Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities*.)
3. The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.

D. Supported Sequence of Operations

1. Characteristics and performance requirements herein shall be supported by the networked lighting control system.
2. Control Zones
 - a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.

- b. Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.
- 3. Wall station Capabilities
 - a. Wall stations shall be provided to support the following capabilities:
 - 1) On/Off of a local control zone and global control zone simultaneously, as required.
 - 2) Continuous dimming control of light level of a local control zone and global control zone simultaneously, as required.
 - 3) Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
 - 4) Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
 - b. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” switching, dimming, preset scene, and profile scene control.
- 4. Occupancy Sensing Capabilities
 - a. Local and global control: Occupancy sensors shall be configurable to control a local and global zone simultaneously, as required.
 - b. Multi-sensor control: multiple occupancy sensors shall be capable of controlling the same local and global control zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
 - c. System shall support the following types of occupancy sensing sequence of operations:
 - 1) On/Off Occupancy Sensing
 - 2) Partial-On Occupancy Sensing
 - 3) Partial-Off Occupancy Sensing
 - 4) Vacancy Sensing (Manual-On / Automatic-Off)
 - d. On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:
 - 1) Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On

sequences the designated occupied light level shall support at least 100 dimming levels.

- 2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels. To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
 - 3) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.
 - 4) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
- e. Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:
- 1) The use of a wall station is required turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.
 - 2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels. To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
 - 3) To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an “automatic grace period” immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
 - 4) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

- f. To accommodate different types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.
- 5. Schedule and Global Profile Capabilities
 - a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wall station input, RS-232/RS-485 command, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
 - b. Global profiles may be scheduled with the following capabilities:
 - 1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - 2) Global Profile time of day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
 - 3) Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.
 - 4) Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
 - 5) System shall support blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule. Wall stations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.
 - 6) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
 - c. System Global Profiles shall have the following additional capabilities:
 - 1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed input devices, scene capable wall stations, and the software management interface.
 - 2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.

- 3) Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
 - d. A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wall station.
6. System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response.

2.4 SYSTEM SOFTWARE INTERFACES

A. Management Interface

1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. Management interface shall require all users to login with a User Name and Password, and shall support creation of at least 100 unique user accounts.
4. Management interface shall support at least three permission levels for users: read-only, read & change settings, and full administrative system access.
5. Management interface shall be capable of restricting access for user accounts to specific devices within the system.
6. All system devices shall be capable of being given user-defined names.
7. The following device identification information shall be displayed in the Management interface: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
8. Management interface shall be able to read the live status of a networked luminaire or intelligent control device and shall be capable of displaying luminaire on/off status, dim level, power measurement, device temperature, PIR occupancy sensor status, microphonic occupancy sensor status, remaining occupancy time delay, photocell reading, and active Scenes or Profiles.
9. Management interface shall be able to read the current active settings of a networked luminaire or intelligent control device and shall be capable of displaying dimming trim levels, occupancy sensor and photocell enable/disable, occupancy sensor time delay and light level settings, occupancy sensor response (normal or vacancy), and photocell setpoints and transition time delays.
10. Management interface shall be able to change the current active settings and default settings for an individual networked luminaire or intelligent control device.
11. Management interface shall be capable of applying settings changes for a zone of devices or a group of selected devices using a single "save" action that does not require the user to save settings changes for each individual device.

12. A printable network inventory report shall be available via the management interface.
13. A printable report detailing all system profiles shall be available via the management interface.
14. All sensitive information stored by the software shall be encrypted.
15. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface

1. System shall provide a historical database that stores device operational history and calculates energy usage for all networked luminaires and intelligent control devices.
2. System shall be capable of reporting lighting system events and performance data back to the historical database for display and analysis.
3. Historical database shall be capable of recording historical data for up to 20,000 networked devices for a period of at least 1 calendar year.
4. An "Energy Scorecard" shall be displayed that shows calculated energy savings in dollars, kWh, or CO₂.
5. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc.).
6. Energy savings data shall be calculated for the system as a whole or for individual zones.
7. A time scaled graph showing all relay transitions shall be presented.
8. A time scaled graph showing a zones occupancy time delay shall be presented
9. A time scaled graph showing the total light level shall be presented.
10. User shall be able to customize the baseline run-time hours for a space.
11. User shall be able to customize up to four time-of-day billing rates and schedules.
12. Historical data shall be exportable from the Historical Database via a "CSV" type of file format.

C. Visualization and Programming Interfaces

1. System shall provide a web-based visualization interface that displays graphical floorplan.
2. Graphical floorplan shall offer the following types of system visualization:
 - a. Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined. This shall include, but not be limited to, the following:
 - 1) Controls embedded light fixtures
 - 2) Controls devices not embedded in light fixtures
 - 3) Daylight Sensors
 - 4) Occupancy Sensors
 - 5) Wall Switches and Dimmers
 - 6) Scene Controllers
 - 7) Networked Relays
 - 8) Bridges
 - 9) System Controllers

10) Zone outlines

- b. Zone Only Option - A master graphic of the entire building, by floor, showing only control zones outlined.
- c. Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor's master graphic.
- d. A mouse click on any control device shall display the following information (as applicable):
 - 1) The device catalog number.
 - 2) The device name and custom label.
 - 3) Device diagnostic information.
 - 4) Information about the device status or current configuration is available with an additional mouse click.

D. Personal Control Applications

- 1. Software interface shall support personal control software applications that provide user-specific control of individual luminaires/control devices, control zones, global scene presets, and scene selector virtual button presses.
- 2. The system administrator shall be capable of defining personal control permissions for each user account.
- 3. Software interface shall provide a Microsoft Windows® operating system taskbar application for personal lighting control.
- 4. Software interface shall provide an Apple iOS ® operating system application (supported by mobile phones and mobile tablet devices) for personal lighting control.

E. Smartphone Programming Interface for Wired Devices

- 1. Application interface shall be provided for both Apple iOS® and Android operating systems that allows configuration of lighting control settings.
- 2. The application shall support the configuration and control of wired networked control devices via a Bluetooth® Low Energy (BLE) Programming Device.
 - a. Application shall support a security pin-code to access the zone of lighting control devices.
 - b. The application shall provide indication of signal strength where multiple Bluetooth Low Energy Programming Devices are available for configuration.
 - c. The application shall indicate the number of wired networked control devices connected to the local daisy-chain zone.
 - d. The application shall provide on/off/dimming control of all control groups.
 - e. The application shall provide the ability to identify all individual luminaires and control devices.
- 3. Programming capabilities through the application shall include, but not be limited to, the following:
 - a. Switch/occupancy/photosensor group configuration
 - b. Manual/automatic on modes
 - c. Turn-on dim level

- d. Occupancy sensor time delays
- e. Dual technology occupancy sensors sensitivity
- f. Photosensor calibration adjustment and auto-setpoint
- g. Trim level settings
- h. Preset scene creation and copy for scene capable devices.
- i. Application of a custom device label.

2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller

- 1. Product Series: nECY
- 2. System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
- 3. System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.
- 4. System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.
- 5. System Controller shall perform the following functions:
 - a. Time-based control of downstream wired and wireless network devices.
 - b. Facilitation of global network switch communication between different system controllers.
 - c. Linking into an Ethernet network.
 - d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
- 6. System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.
- 7. Device shall have option for a graphical touch screen to support configuration and diagnostics.
- 8. Device shall have three RJ-45 networked lighting control ports for connection to any of the following:
 - a. The graphical touch screen
 - b. Wired communication bridges
 - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)
- 9. Device shall be capable of communicating with wireless network bridges and software interfaces via LAN connection.
- 10. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
- 11. Device shall have a standard and astronomical internal time clock.

12. Device shall have 2 switched RJ-45 10/100 BaseT Ethernet ports for local area network (LAN) connection.
 - a. Ethernet connection shall support daisy chain wiring to other lighting control system LAN devices, such as other system controllers and wireless networked communication bridges.
 - b. Ethernet connection shall support IPv4 and shall be capable of using a dedicated static or DHCP assigned IP address.
 13. Device shall have 2 x USB 2.0 Expansion ports for 802.11 Wi-Fi Adapter enabling wireless connectivity including:
 - a. Hot Spot
 - b. Access Point
 - c. Client
 14. Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).
 - a. Multiple System Controllers may be networked together via LAN connection to scale the system up to 20,000 networked devices.
 15. System Controller shall support BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
 - a. BACnet MS/TP shall support 9600 to 115200 baud rate.
 - b. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
 16. System controller shall contain a “FIPS 140-2 Level 1 Inside” cryptographic module.
 17. System controller shall be available within a NEMA 1 enclosure with Class 1 and Class 2 separation
 - a. Enclosure shall support power input power of 120-277VAC, or optional 347VAC
- B. OpenADR Interface
1. Product Series: nADR
 2. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
 3. OpenADR interface shall meet all the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
 - a. Programmable with the account information of the end-user’s electrical utility DRAS account credentials.
 4. OpenADR interface shall support the activation of demand response levels defined in the utility demand response program.

2.6 WIRED NETWORK DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers

1. Product Series: nPODM, nPODM xS, nPODM xL

2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
 6. Devices with mechanical push-buttons shall be made available with custom button labeling.
 7. Wall switches & dimmers shall support the following device options:
 - a. Number of control zones: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
 - c. Colors: Ivory, White, Light Almond, Gray, Black, Red
 8. Scene controllers shall support the following device options:
 - a. Number of scenes: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) Preset Level Scene Type
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature
 - 5) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - 6) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - c. Colors: Ivory, White, Light Almond, Gray, Black, Red
- B. Wired Networked Graphic Wall Stations
1. Product Series: nPOD-GFX
 2. Device shall surface mount to single-gang switch box.
 3. Device shall have a 3.5" full color touch screen.

4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
 5. Device shall have a micro-USB style connector for local computer connectivity.
 6. Communication shall be over standard low voltage network cabling with RJ-45 connectors.
 7. Device shall enable user supplied screen saver image to be uploaded within one of the following formats: jpg, png, gif, bmp, tif.
 8. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
 9. Graphic wall stations shall support the following device options:
 - a. Number of control zones: Up to 16
 - b. Number of scenes: Up to 16
 - c. Profile type scene duration: User configurable from 5 minutes to 12 hours
 - d. Colors: Ivory, White, Light Almond, Gray, Black
- C. Wired Networked Auxiliary Input / Output (I/O) Devices
1. Product Series: nIO-1S, nIO-RLX, nIO-MLO-5STEPA, nIO-MLO-AB, nIO-NLI, nIO-X, nIO-D, nIO-EZ-PH, nIO-EZD
 2. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½” knockout.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
 - a. Contact closure or Pull High input
 - 1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input
 - 1) Input shall be programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input
 - 1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - d. 0-10V dimming control output, capable of sinking up to 20mA of current
 - 1) Output shall be programmable to support all standard sequence of operations supported by system.
 - e. Digital control output via EldoLED LEDcode communication
 - 1) Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

D. Wired Networked Occupancy and Photosensors

1. Product Series: nCM, nCMB, nRM, nWV, nHW
2. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
3. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
4. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
5. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
6. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
7. System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.
8. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
9. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
10. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.
11. Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
12. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.
13. Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.
14. Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
15. Photosensor and dimming sensor’s set-point and dead band shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.

16. Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
 17. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an “offset” from the primary zone.
- E. Wired Networked Wall Switch Sensors
1. Product Series: nWSX
 2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 5. Devices with mechanical push-buttons shall provide tactile user feedback.
 6. Wall switches sensors shall support the following device options:
 - a. User Input Control Types Supported: On/Off or On/Off/Dimming
 - b. Occupancy Sensing Technology: PIR only or Dual Tech acoustic
 - c. Daylight Sensing Option: Inhibit Photosensor
 - d. Colors: Ivory, White, Light Almond, Gray
- F. Wired Networked Embedded Sensors
1. Product Series: nES
 2. Network system shall have embedded sensors consisting of occupancy sensors and/or dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
 3. Occupancy sensor detection pattern shall be suitable for 7.5’ to 20’ mounting heights.
 4. Embedded sensors shall support the following device options:
 - a. Occupancy Sensing technology: PIR only or Dual Tech acoustic
 - b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- G. Wired Networked Power Packs and Secondary Packs
1. Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P-LVR, nSHADE, nAR40, nEPS 60, nPS-80
 2. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
 3. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
 4. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.

5. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.
6. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
7. Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.
8. Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
9. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
10. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
11. Power/Secondary Packs shall be available with the following options:
 - a. Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - b. Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - c. Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.
 - d. Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
 - e. Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
 - f. Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.
 - g. Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.
 - h. Secondary Pack capable of louver/damper motor control for skylights.
 - i. Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
 - j. Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).
 - k. Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

H. Wired Networked Luminaires

1. Product Series: Networked Luminaires shall be LED fixtures, which come factory enabled with embedded networking capability:
2. Networked luminaire shall have a mechanically integrated control device.
3. Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter).
4. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers).
5. Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG and CCT capable versions).
6. System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports "sleep mode."
7. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
 - a. System shall indicate (via a blink warning) when the LED luminaire is no longer able to compensate for lumen depreciation.
8. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
9. System shall be able to provide control of luminaire intensity, in addition to dynamic features, such as grayscale and color accent of specific LED luminaires.

I. Wired Networked Bluetooth® Low Energy Programming Device

1. Product Series: nIO BT
2. Device shall be plenum rated and be inline wired, screw mountable.
3. Communication and low voltage power shall be delivered to device via standard low voltage network cabling with RJ-45 connectors.
4. Bluetooth Low Energy connection shall allow connection from smartphone application for programming device settings within the local daisy-chain zone (*see list of available settings in section 2.4-System Software Interfaces, Sub-section E*).
 - a. Device shall provide visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.

J. Wired Networked Communication Bridge

1. Product Series: nBRG
2. Device shall surface mount to a standard 4" x 4" square junction box.
3. Device shall have 8 RJ-45 ports for connection to lighting control zones (up to 127 devices per port), additional network bridges, and System Controller.
4. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.

5. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply, or powered via low voltage network connections from powered lighting control devices (e.g. power packs).
6. Wired Bridge shall be capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

PART 3 – EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Installation Procedures and Verification

1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - b. Length
 - c. Insertion Loss

B. Coordination with Owner's IT Network Infrastructure

1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
 - a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
 - b. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Documentation and Deliverables

1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
 - a. As-Built floor plan drawings showing daisy-chain wired network control zones outlined, in addition to device address locations required above. All

documentation shall remain legible when reproducing\scanning drawing files for electronic submission.

- b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image: Titleblock Text- Inclusive of room names and numbers, fixture tags and drawings notes Fixture wiring and homeruns Control devices Hatching or poché of light fixtures or architectural elements
 - 2) CAD files shall be of AutoCAD 2013 or later. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 SYSTEM STARTUP

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
 - 1. Low voltage network cable testing shall be performed prior to system startup.
- B. System start-up and programming shall include:
 - 1. Verifying operational communication to all system devices.
 - 2. Programming the network devices into functional control zones to meet the required sequence of operation.
 - 3. Programming and verifying all sequence of operations.
 - 4. Customization of owner's software interfaces and applications.
- C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

3.3 PROJECT TURNOVER

- A. System Documentation
 - 1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
- B. Owner Training
 - 1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION 26 0923

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SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade duplex straight-blade receptacles.
3. Connectors, cords, and plugs.

B. Related Requirements:

1. Section 26 0010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 01 3100 "Project Management and Coordination" for preinstallation conference procedures.
3. Section 26 0923 "Network Lighting Controls" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.
4. Section 26 5119 "LED Interior Lighting" for network lighting control solid-state devices.

1.2 DEFINITIONS

- A.** Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.
- B.** UL 1472 Type I Dimmer: Dimmer in which air-gap switch is used to energize preset lighting levels.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Toggle switches.
2. Key lock switches.
3. Maintained-contact switches.
4. Duplex straight-blade receptacles.
5. Receptacles with GFCI device.
6. Spring-driven commercial/industrial-use cord reels.

1.4 INFORMATIONAL SUBMITTALS

- A.** Manufacturers' Instructions: Record copy of official installation instructions issued to Installer by manufacturer for the following:
1. Dimmers.
 2. Duplex straight-blade receptacles.
 3. Duplex straight-blade receptacles with integral switching means.
 4. Receptacles with GFCI device.
 5. Spring-driven commercial/industrial-use cord reels.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Extra Keys for Key Lock Switches: 3.

1.6 WARRANTY FOR DEVICES

- A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.
 - 1. Initial Extended Warranty Period: 1 year from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES

- A. Toggle Switch with Forked Key Lock:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
 - 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 3. General Characteristics:
 - a. Reference Standards: UL CCN WMUZ and UL 20.
 - 4. Options:
 - a. Device Color: Ivory.
 - b. Configuration:
 - 1) 120-277 V, 20 A, three way or four way, verify in field.

2.2 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

- A. General-Grade, Weather-Resistant (WR), Duplex Straight-Blade Receptacle with GFCI Device and protective UL listed while in use cover:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
3. General Characteristics:
 - a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.
4. Options:
 - a. Device Color: Ivory.
 - b. Configuration: Heavy-duty, NEMA 5-20R.
5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.3 CONNECTORS, CORDS, AND PLUGS

- A. Outdoor-Use, Watertight, Sealed Cord Connector:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ericson Manufacturing Company.
 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 3. General Characteristics:
 - a. Reference Standards: UL CCN AXUT and UL 498.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receptacles:
 1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.
- B. Identification:
 1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

3.3 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Identification:
 - 1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF CONNECTORS, CORDS, AND PLUGS

- A. Comply with manufacturer's instructions.

3.5 FIELD QUALITY CONTROL OF SWITCHES

- A. Tests and Inspections:
 - 1. Perform tests and inspections in accordance with manufacturers' instructions.
- B. Nonconforming Work:
 - 1. Unit will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.

3.6 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

- A. Tests and Inspections:
 - 1. Insert and remove test plug to verify that device is securely mounted.
 - 2. Verify polarity of hot and neutral pins.
 - 3. Measure line voltage.
 - 4. Measure percent voltage drop.
 - 5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
 - 6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
- B. Nonconforming Work:
 - 1. Device will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Assemble and submit test and inspection reports.

3.7 FIELD QUALITY CONTROL OF CONNECTORS, CORDS, AND PLUGS

- A. Tests and Inspections:
 - 1. Perform tests and inspections indicated in manufacturer's instructions.
- B. Nonconforming Work:
 - 1. Unit will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.

3.8 SYSTEM STARTUP FOR SWITCHES

- A. Perform startup service.
 - 1. Complete installation and startup checks for momentary switches, dimmer switches, and fan-speed controller switches in accordance with manufacturer's instructions.

3.9 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

B. Connectors, Cords, and Plugs:

1. After installation, protect connectors, cords, and plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 2726

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SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
1. Interior lighting fixtures with LED lamps.
 2. Lighting fixtures mounted on exterior building surfaces.
 3. Exit signs.
 4. Accessories.
- B. Related Sections include the following:
1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors and manual wall-box dimmers for LED fixtures.

1.3 DEFINITIONS

- A. CRI: Color rendering index.
- B. CU: Coefficient of utilization.
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.
- D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.
- E. RCR: Room cavity ratio.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. All lighting fixture types shall be submitted in a single complete brochure, at the same time, which shall be in the form of a soft cover binder with each fixture separated by an identified index tab. Information on each fixture shall include data on features, accessories, and the following:
1. Physical description of fixture, including dimensions and verification of indicated parameters.
 2. Fluorescent and high-intensity-discharge ballasts.
 3. Lamps.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems for lighting fixtures will be attached.
 4. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 5. Perimeter moldings.
- B. All submittals of NON SPECIFIED fixtures must include documentation or they will be automatically rejected.
- C. Wiring Diagrams: Power, signal, and control wiring.
- D. Samples for Verification:
- a. For interior lighting fixtures designated for sample submission in the Interior Lighting Fixture Schedule.
 - 1) Lamps: Specified units installed.
 - 2) Ballast: 120-V models of specified ballast types.
 - 3) Accessories: Cords and plugs.
 - b. Substitution fixtures as requested by the engineer at time of submittal.
 - 1) Lamps: Specified units installed.
 - 2) Ballast: 120-V models of specified ballast types.
 - 3) Accessories: Cords and plugs.
 - c. Paint sample for light poles and associated luminaires.
- E. Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.
- F. Source quality-control test reports.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section Closeout Procedures include the following:
1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.
- I. Warranties: Special warranties specified in this Section.
- J. Submittals that fail to comply with the above requirements will automatically be rejected.
- K. It is the Contractor's responsibility to provide submittals in an organized and timely manner in order so as not to delay the project schedule and hamper the work of other trades.
- L. All submittals of NON SPECIFIED equipment and components will be reviewed. It is the submitting Contractor's responsibility to prove compliance and not the Architect/Engineer to prove non-compliance. The submitting Contractor will be charged the prevailing wage of the reviewing Engineer for all submittals requiring over one (1) hour to review that were not originally specified.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- N. 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.
- O. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- P. Comply with NFPA 70.
- Q. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Refer to Luminaire Schedule for specified products and manufacturers.
 - 1. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a product of equal performance and construction.
 - 2. Non specified products will be subject to possible request of point by point calculations and samples for comparison.

2.2 FIXTURES AND COMPONENTS, GENERAL

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- D. 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.
- E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- F. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
 - 3. All fixture lenses shall meet ASTM E-84, maximum smoke developed of 450 and ASTM E-635, maximum burn rate of 2.5 inches per minute.
- G. Electromagnetic-Interference Filters: A component of fixture assembly. Suppress conducted electromagnetic-interference as required by MIL-STD-461D. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Die-cast aluminum housing and canopy.
- C. Universal snap-out directional arrows as required.
- D. Single and double face housing as required.
- E. Universal mounting with canopy.
- F. Internally Lighted Signs:
 - 1. Lamps for AC Operation: White, light-emitting diodes, 70,000 hours minimum of rated lamp life.
- G. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty. Battery to deliver 90 minute minimum capacity to fixture.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.4 LED SOURCES

- A. LEDs to meet LM-80 performance for 50,000 hours

- B. High efficiency driver
- C. Standard full range dimming on troffers.
- D. 5-year warranty of entire fixture including fixture construction and LED light engine driver.
- E. LED lamp minimum CRI of 82
- F. Fixture tested in accordance with IESNA LM-79.

2.8 FIXTURE SUPPORT COMPONENTS

- G. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- H. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- I. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- J. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, [12 gage].
- K. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- L. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- M. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- N. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.9 FINISHES

- O. Fixtures: Manufacturers' standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

2.10 SOURCE QUALITY CONTROL

- P. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.
- Q. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Complete all of the following:
 - 1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3 and be supported by building steel (not ceiling system grid supports).

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- C. Suspended Fixture Support: As follows:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 4. Continuous Rows: Suspend from cable.
- D. Adjust aimable fixtures to provide required light intensities.

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 26 5100

SECTION 27 0000 – COMMUNICATIONS INSTALLATION OVERVIEW

PART 1 - INSTALLATION OVERVIEW

1.1 SUMMARY

- A. This project encompasses the installation of high capacity cabling backbone and associated hardware to support high-bandwidth communications.

1.2 THE COMPONENTS ASSOCIATED WITH THIS PROJECT ARE:

- A. Conduit and Wiremold will be used to provide a protected pathway for all cables routed or installed in an exposed environment. The pathways for this project are included in the Division 26 000 series of specifications.
- B. CAT6, twisted pair cabling will be home run between each telephone and data drop location to the nearest associated telecom closet.

1.3 RELATED SECTIONS

- A. Drawings and general provisions of contract, including General and Supplementary conditions and Division 1 Specifications sections, apply to work in this section.

PART 2 - INSTALLATION PROCESS

2.1 INSTALLATION OF CONDUIT AND WIREMOLD

- A. Unless otherwise stated on drawings, Electrical Contractor under Division 26 of this specification is to provide and install conduit and/or Wiremold in all situations where cabling exits ceiling cavities. All proposed cable routes and drop locations are approximate and should be verified by the contractor. Cable lengths indicated are approximate. It is the contractor responsibility to verify cable distances prior to cutting and routing of cables. It is the contractor responsibility to verify locations and quantities of drops.
- B. All vertical cable runs between floors will be routed in conduit unless installed in a designated wiring closet, existing ceiling cavity, or specified differently. Vertical conduit runs shall be floor to ceiling or terminate in drop ceiling cavities. In all locations, penetration into the corridor ceiling cavities will be continuous and require the replacement of fire stop materials.
- C. All core drills that are required shall be provided by the electrical contractor, unless otherwise noted. It is the responsibility of the contractor to verify locations with school officials prior to drilling and to fire stop in accordance with local and state codes.

PART 3 - EXECUTION

3.1 CABLING

- A. All cables shall be routed in accordance with state and local codes and regulations. All cables installed and terminated shall follow the guidelines set forth by the manufacturer.
1. When routing cables through ceiling cavities all cables shall be supported by bridal rings in a bundled manor and shall not be supported or rest on drop ceiling components. Cables shall be

neatly swept and bundled. The maximum allowable cable sag between supports will be 6 inches as measured vertically. All cable will be run to deck height while in ceiling cavities and fastened to roof supports or the bottom of the deck.

B. Drop locations

1. Drop locations and types are as specified on the associated drawings. All locations are approximate and should be verified with district personnel prior to implementation.

3.2 LABELING

- A. All cables are to be labeled at both the origination and termination locations using as specified a permanent alpha numeric cabling system. Cables shall be labeled at all junction points where a single continuous cable is not used, such as in a splice panel or Demarc.
- B. Each faceplate shall have identification, which includes the cable number, and drop number if more than one of the same type of drop is installed in the room.
- C. Testing
1. CAT6 cables will be tested as per manufacturers' criteria, EIA/TIA and test specifications identified in this design.

PART 4 - COMPLETION

4.1 PROJECT COMPLETION

- A. All documentation will be completed as specified. All cabling will be neat and secure.
- B. Passing of data from each drop location will be done as specified, in conjunction with Owner. Refer to testing in the general specification section.
- C. All facilities such as walls, ceilings etc., shall be restored to as found or better condition. All fire barriers breached shall be restored / sealed as to local, state and federal codes.
- D. The removal of any construction or installation debris as a result of this project.
- E. The Owner is to be consulted on any alterations of wiring closets, riser locations, and drop locations as required. Should conflicts between this design and the actual install or should any unforeseen circumstance occur during installation the contractor shall consult immediately with an authorized agent of the Owner.

END OF SECTION 27 0000

SECTION 27 5117 - MODIFICATIONS TO EXISTING PUBLIC ADDRESS SYSTEM

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 modifications to existing PA system cabinet front end equipment, new speakers and system wiring. System shall accommodate devices on plan and include full programming of existing Rauland Telecenter system.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each component, including detailed manufacturer's specifications.
- C. Shop Drawings detailing the system including, but not limited to, the following:
 - 1. A single-line block diagram showing interconnection of all components for the systems Station-arrangement scale drawings for built-in equipment.
- D. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance.
- E. Product certificates signed by manufacturers of equipment, certifying that their products comply with specified requirements.
- F. Installer certificates signed by manufacturer certifying that Installers comply with requirements specified under the "Quality Assurance" Article. Upon request, submit evidence of experience and of relationship with system manufacturer.
- G. Manufacturer certificates signed by manufacturer certifying that manufacturers comply with requirements specified under the "Quality Assurance" Article. Upon request, submit evidence of manufacturing experience.
- H. Report of field tests and observations, including record of final matching transformer tap settings, and signal ground-resistance measurement certified by Installer.
 - 1. Maintenance data for system, to be included in the operation and maintenance manual specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer, who is an authorized representative of the system manufacturer to perform Work of this Section.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing school intercom and program systems complying with the requirements of these Specifications and experienced with at least 5 projects of similar size and scope.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
- D. Comply with NFPA 70.
- E. Comply with UL 50.

1.6 SEQUENCING AND SCHEDULING

- A. Existing PA Equipment: In all areas, maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until new equipment is accepted. Remove tags from new equipment when put into service and tag existing equipment "NOT IN SERVICE" until removed from the building. Provide conductors, conduit, etc. as required to maintain existing equipment disturbed by new work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Rauland Telecenter.

2.2 SYSTEM DESCRIPTION

- A. The modified system will function as before accept for the addition of devices as shown on the drawings.
- B. PA work includes but is not limited to the following:
 1. Equipment as required for modifications.
 2. Additional devices as shown on drawings.
 3. Warranty.

2.3 EQUIPMENT AND MATERIALS

- A. Equipment: Modular type using all solid-state circuits, except as otherwise indicated.
- B. Cone-Type Loudspeakers/Speaker- Ceiling Flush: Comply with EIA-SE-103. Incorporate the following ratings and features:
 1. Average Sensitivity: 90 dB SPL, 1W/1M.
 2. Frequency Response: Within plus or minus 3 dB from 60 to 17,000 Hz, 426A standard.
 3. Dispersion Angle: 90 degrees, -6 dB / 2 kHz, half space.
 4. Matching Transformer: Comply with EIA-160. 25/70V 5 watt, 5 level taps. Maximum insertion loss of 0.5 dB. Power rating equal to speaker's
 5. Enclosures: T-Bar ceiling bracket with, factory baffle. Flush ceiling mounting where indicated on drawings.
 6. Baffle: For flush speakers, provide a speaker baffle of at least 4-1/4 inch aluminum, brushed to a satin sheen and lacquered.

7. Size: 8 inch O.D. diameter dual cone loud speaker with a 10-oz. BeFe Ceramic magnet, except as otherwise indicated.
 8. Rauland to match existing building type or an approved equal.
- I. Grounding Components: As specified in Division 260526 Section "Grounding And Bonding For Electrical Systems."

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

- A. Test of Existing System:
1. Prior to performing any work, test existing system to ascertain its operating condition.
 2. Test shall be witnessed by the Owner's Representative.
 3. Repairs to the existing system are not included in the Work unless requested Owner.
- B. Upon completion of the work, system is to be retested and shall perform as indicated in report prior to start of work. Any discrepancies shall be corrected at no cost to contract/Owner.

3.2 INSTALLATION

- A. Install equipment to comply with manufacturer's written instructions.
- B. Wiring Method: Install wiring in surface raceway except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings
- C. Install raceway parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed as not to damage the cables. Secure cable at intervals not exceeding 30 inches (762 mm) and not more than 6 inches (152 mm) from cabinets, boxes, or fittings.
- D. Wiring Within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars in cabinets.
- E. Control Circuit Wiring: Provide number and size of conductors as recommended by system manufacturer for control functions indicated.
- F. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Run in separate raceways or, where exposed or in same enclosure, provide 12-inch (305-mm) minimum separation between conductors to speaker microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other school intercom and program system conductors.
- G. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures.
- H. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- J. Repairs: Where walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.3 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements of Division 26 Section "Grounding."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components, perform the initial system programming, and oversee the testing and adjustment of the system.
- B. Programming: Fully brief the Owner on programming options available for the system. Record his programming decisions and set up the initial programming of the system. Provide the Owner with a written record of the decisions, implementation methodology, and final results.
- C. Test Procedure: Conform to the following:
 - 1. Schedule tests a minimum of 7 days in advance of performance of tests. Coordinate through Owner's Representative.
 - 2. Report: Submit a written record of test results.
 - 3. Operational Test: Perform operational system test to verify conformance of system to these Specifications.
- D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- E. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.

3.5 CLEANING

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 27 5117

SECTION 28 0153 – CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. RS-232 cabling.
 2. RS-485 cabling.
 3. Fire alarm wire and cable.

1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. Polypropylene insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. PVC jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. Plastic insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. Plastic jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.

2.2 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM or CMG.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.3 FIRE ALARM WIRE AND CABLE

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. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire; a brand of Belden Inc.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

3.0 WIRING METHOD

A. Install wiring in metal pathways and wireways.

1. Minimum conduit size shall be 3/4 inch. Control and data-transmission wiring shall not share conduits with other building wiring systems.
2. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems."

B. Install cable, concealed in accessible ceilings, walls, and floors when possible.

3.1 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 26 0529 "Hangers and Supports for Electrical Systems."
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 - 1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - 2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.2 CONNECTIONS

- A. Comply with requirements in Section 28 3111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.3 FIRESTOPPING

- A. A Comply with requirements in Section 07 8413 "Penetration Firestopping."
- B. Comply with TIA-569-D.
- C. Comply with BICSI Information Technology Systems Installation Methods Manual.

3.4 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. Prepare test and inspection reports.

END OF SECTION 28 0153

SECTION 28 3111 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this section includes the following: Modifications to the existing Simplex 4100es Fire Alarm System in the building. Modifications to include additional notification devices, initiating devices, addressable relays, one remote annunciator panel, support equipment, and all wiring, components, connections, and testing.

1.2 SCOPE & RELATED DOCUMENTS

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings and as herein specified.
- B. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.
- C. The complete installation is to conform to the applicable sections of NFPA-72, Local Code Requirements and National Electrical Code with particular attention to Article 760.
- D. Additionally, the entire installed system and all integrated system operations shall be within the guidelines of the SBCCI Standard Building Code.
- E. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.3 QUALITY ASSURANCE

- A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
- B. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type (software driven) of equipment for at least ten (10) years, and has a fully-quipped service organization within thirty-five (35) miles of the installation.
- C. All control equipment must have transient protection devices to comply with UL864 requirements.
- D. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760.
- E. Supplier shall provide documentation that fire alarm technicians are NICET LEVEL 2 certified (minimum of 4)
- F. Suppliers' service organization must have been established in the local Cuba/Rushford area for a minimum of ten (10) years with ten (10) years experience on specific equipment brand supplied.

1.4 GENERAL

- A. Make all connections to the existing building system and leave the entire fire alarm system in first class operating condition.
- B. Add smoke detectors, heat detectors, carbon monoxide detectors, horns (A/V's), visuals, etc., all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.
- C. All peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

PART 2 - PRODUCTS**2.1 PERIPHERAL DEVICES**

- A. The Contractor shall furnish and install devices that are compatible with the existing Simplex 4100ES Fire Alarm Control Panel in the building.
- B. Devices Required but not limited to:
 - 1. Photoelectric Smoke Detectors
 - 2. Duct Smoke Detectors
 - 3. Visual Alarm (Strobe) Stations
 - 4. Combination Horn/Strobe Stations
 - 5. Monitor Modules
 - 6. Heat/Smoke Detector Bases
 - 7. Intelligent Relay Bases
 - 8. Control Relay Modules
 - 9. Magnetic door hold opens
 - 10. Addressable Relay Modules
 - 11. NAC panel and 120v power as required for a complete operating system.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor.
- B. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
- C. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- D. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- E. The manufacturer's authorized representative shall provide on-site supervision of installation.

3.2 TESTING

- A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall certify in writing to the owner and general contractor.

3.3 WARRANTY

- A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use

END OF SECTION 28 3111

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